April 10, 1939

STEEL

DUCTION • PROCESSING • DISTRIBUTION • USE
ESTABLISHED 1882

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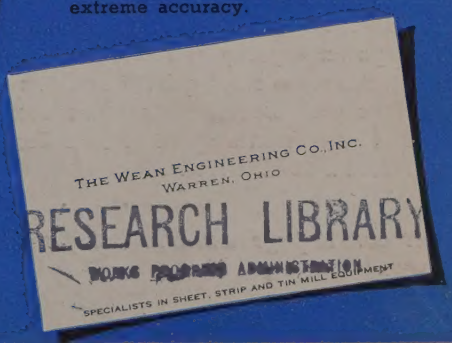
WEAN

HI-SPEED TIN PLATE SHEARING LINE

THE Wean Tin Plate Shearing Line for uncoiling, side trimming, cutting to accurate length, classifying and piling will give maximum tonnage with high speed operation. This equipment is guaranteed to shear and pile with extreme accuracy.



ISTS IN SHEET, STRIP AND TIN MILL EQUIPMENT

Do Planer Jobs Faste with this IMPROVED RELIANCE REVERSING MOTOR-D

48" x 90" x 12' Cincinnati Open-side Planer with Reliance Reversing Motor-drive; 30 hp. 100-600 rpm. motor.

Fast. Planers powered with this new Drive are reversing faster than ever be is clipped from the reversal period an to cutting time with more finished pi ing off the planer.

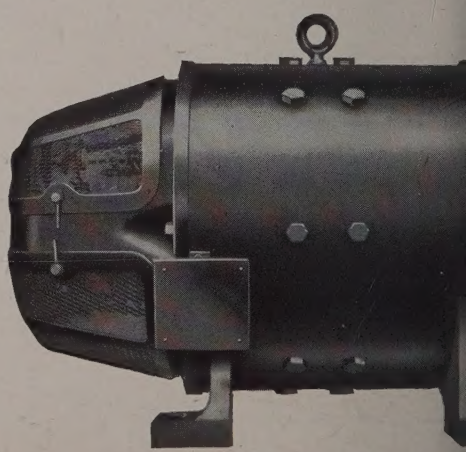
Convenient. Improved push but rheostats provide centralized control time in setting-up. A new, direct-acti reversing switch brings more snap with greater accuracy.

Dependable. Safety features ins stopping if unusual conditions inte normal operations. The protection and work is prompt and certain at a

MOTOR-DRIVE IS MORE THAN

Why It Is Quicker-acting

Making use of the principle that a slow-moving mass can be stopped in less time with the same effort than when moving at a higher rate of speed, Reliance Engineers quickened reversals by reducing armature speeds from the former standards of 250-1000 rpm. and 200-1000 rpm. to 150-600 rpm. and 100-600 rpm., still maintaining full horsepower capacity over the entire range. The improved drive, therefore, stops quicker and gets under way quicker for the same basic reason that you can stop your automobile in less time from a speed of 30 miles an hour than you can from a 60-mile rate.



. . .

Get our 12-page Bulletin 306 for interesting details.

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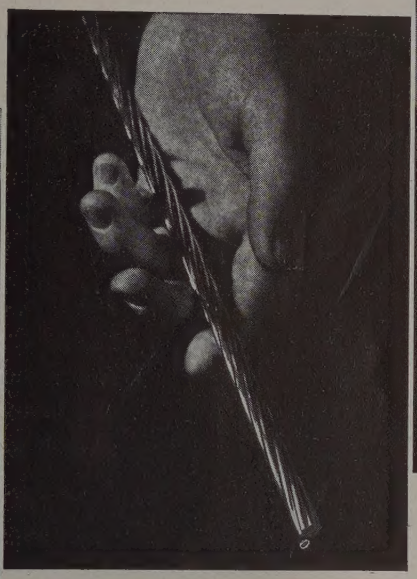

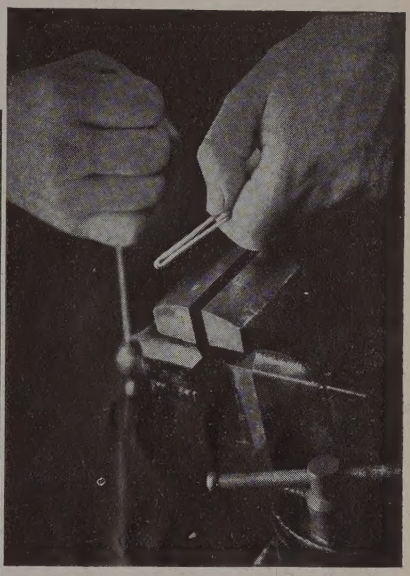

BETHANIZED WIRE

...ill stand your most drastic fabrication

...bethanized coating is so ductile as a result of its ...eme purity, and so much a part of the wire be... ...e of its secure bonding, that the coating will bear ...nder practically any fabricating operation the wire ...stand. Hence, however drastic the bending and ...ing, there is no need to risk either loss of protec... ...from flaking of the zinc or to incur the expense ...nortcomings of galvanizing after fabricating.

Bethanized wire adds to the durability of products as much as it facilitates manufacture. Since the coating is inherently uniform in thickness—we couldn't make it uneven if we wanted to—there are no thin spots to limit the life of the coating. And since there is practically no limit to the thickness of a bethanized coating, you can have as much zinc put on as conditions warrant.

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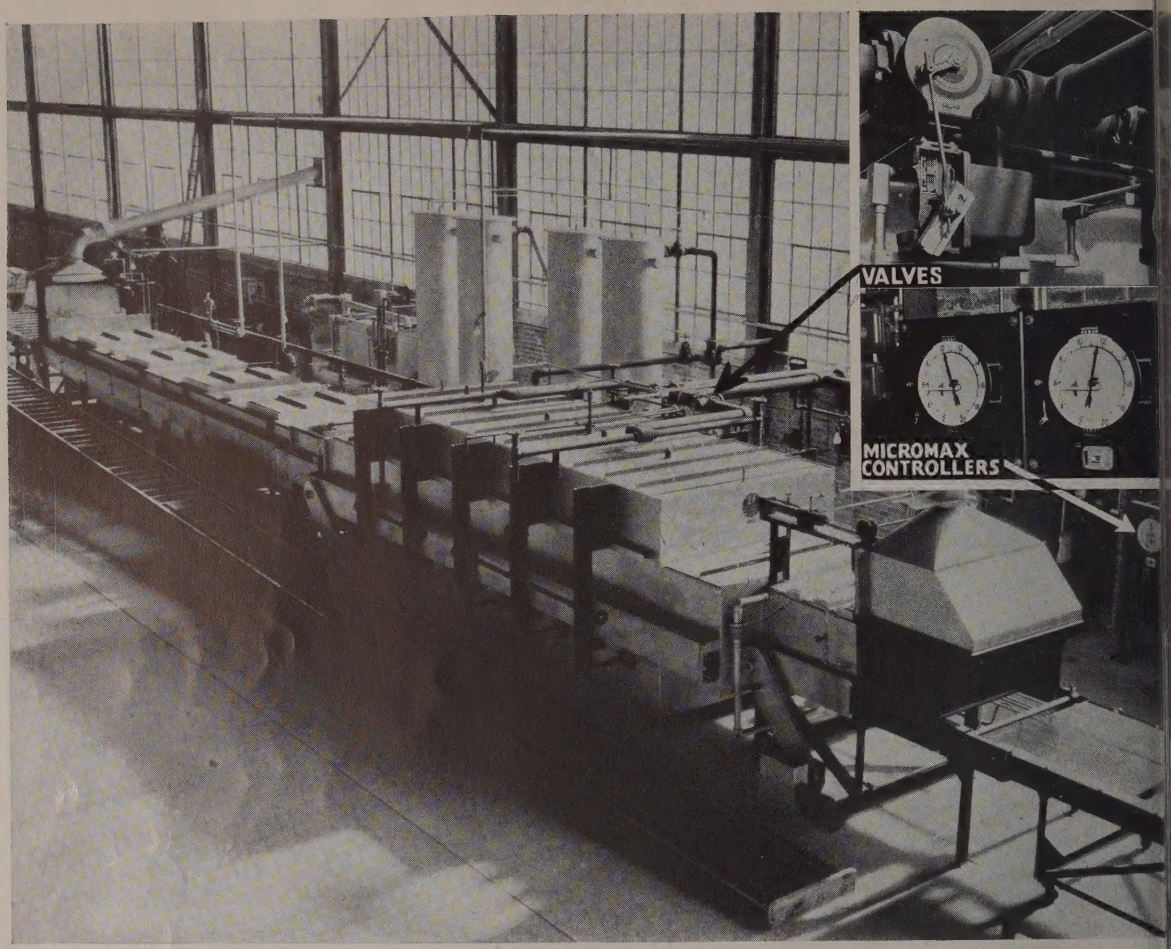

Tubing of brass, copper and aluminum, made by Penn Brass & Copper Co., Erie, Pa., is annealed in this Electric Furnace Co. controlled-atmosphere bright-annealing furnace, with temperature regulated by two M Electric Control equipments.

Uniform GRAIN SIZE IS EASIER TO G
WITH MICROMAX ELECTRIC CONTROL

Because correct grain-size is vital to good tubing, and because annealing temperature is a main factor in regulating grain size, the Penn Brass & Copper Co. "played safe"—insisted that the temperature regulation on their furnace must have the "micro-action" of Micromax Electric Control. Thus they are assured of the same dependable service received from their older L&N instruments, plus the micro-detecting and balancing action which act even the tiniest changes—heads them of gardless of size—to produce temperatur constant that manufacture of uniform tubi greatly facilitated.

Because of its automatic adjustments fo and load, Micromax Electric Control ma applied to the needs of any heat-using pro

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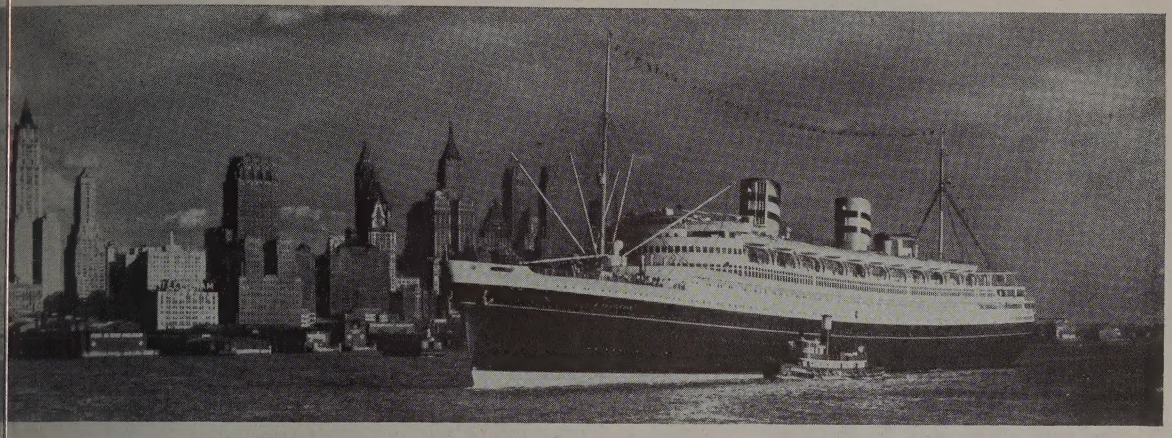
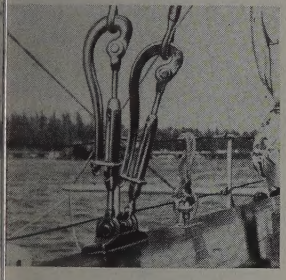
Jrl Ad N-33A-626(1)

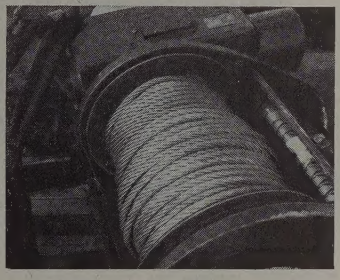
Vol. 104, No. 15, April 10, 1939, issue of STEEL, published every Monday at Cleveland, O. Entered as second-class matter at the postoffice, Cle O., under act of March 3, 1879. U. S. and Canada: 1 year, $4; 2 years, $6; foreign countries, 1 year, $10; Current issues, 25c.

STAINLESS STEEL sails the seas and laughs at the salty spray



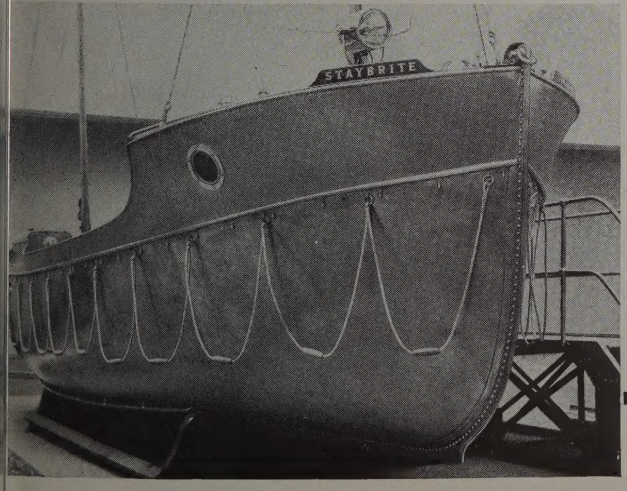
The Nieuw Amsterdam, new queen of the Netherlands merchant marine, makes extensive use of stainless steel for sinks, shelves, utensils, doors, furniture trim, and many other applications, to keep food clean and the surroundings bright.





Stainless steel fittings and cables like these on the 67-foot motor sailer, Mercury IV, are strong and tough and do not rust even in salt air and salt water.

This all-stainless steel lifeboat is a light, strong, welded craft 28 feet long and motor driven. It is fittingly named "Staybrite" after the stainless steel of which it is made because this steel "stays bright" in sea water and sea air.



YES, stainless steel laughs at the salty spray because sea air and sea water do not mar its bright surface. In these examples, as in hundreds of other applications on land, the high strength-weight ratio and corrosion resistance of stainless steel are being used to save weight, lower maintenance, and lengthen life . . . Wherever dead weight and corrosion are eating your profits, you should consider the possibilities of stainless steel.

Though not manufacturers of steel, we have for over thirty years made "Electromet" ferro-alloys and metals for use in making iron and steel. A fund of data on stainless and other alloy steels and irons has thus been developed. This information and the assistance of our metallurgists are available to help you select alloy steels suitable for your purposes. Make use of this service today.

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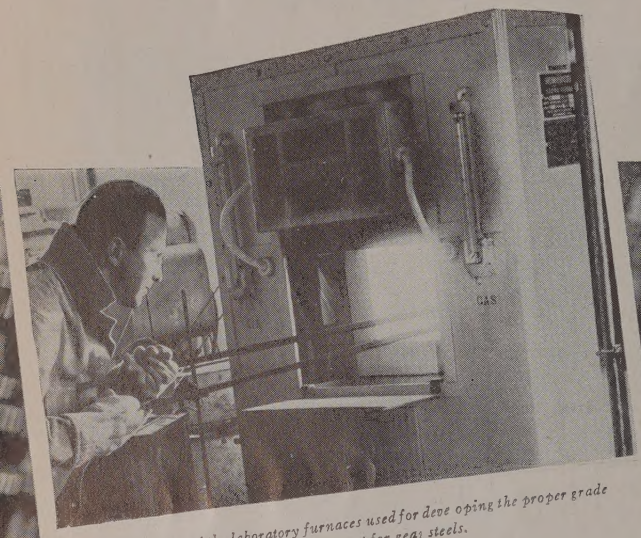
Making Gears ?..th

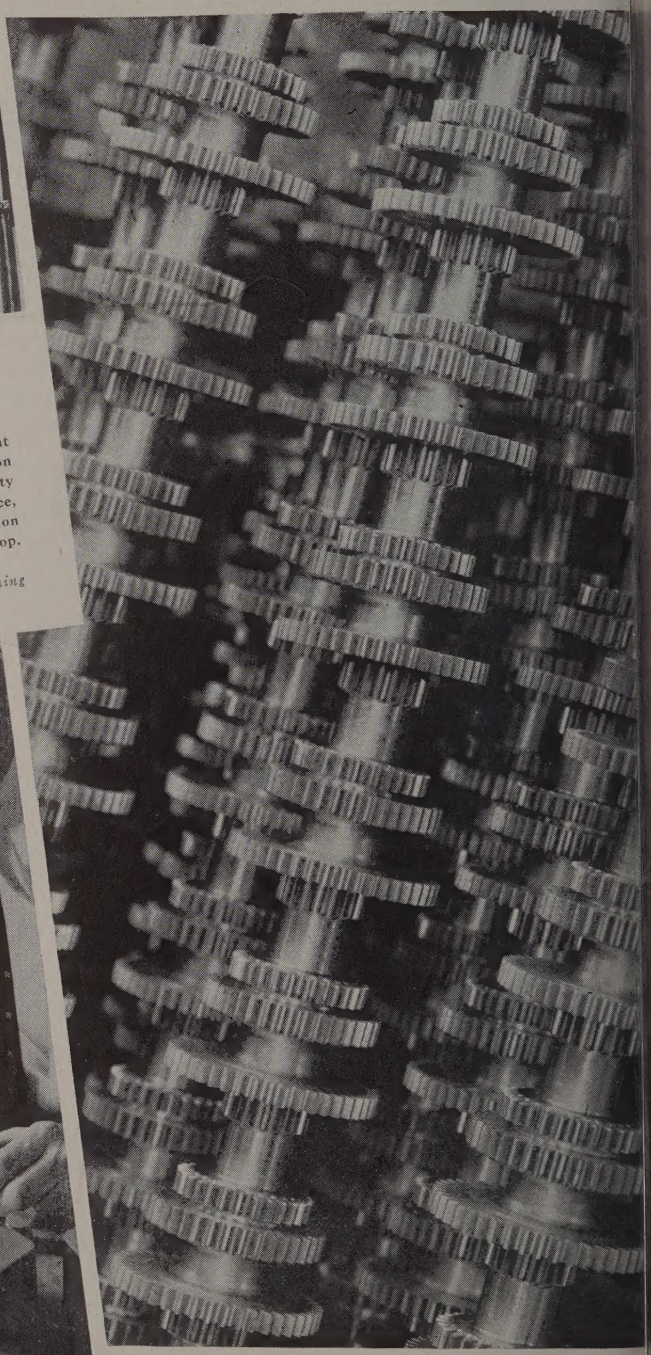


Above — One of the laboratory furnaces used for developing the proper grade and heat treatment for gear steels.

NOTHING IS LEFT TO CHANCE

Precise uniformity of control is exercised in every step in every heat of U·S·S Carilloy Steel produced. It includes uniformity of selection of scrap for furnace charge, uniformity of furnace practice, uniformity of slag control, uniformity of tapping, pouring and rolling practice, and uniformly close metallurgical control, supervision and inspection throughout the above steps until the steel is delivered to your shop.

Below — Ascertaining steel hardenability by macroscopically examining fractured samples and etched sections.



UNITE

s Uniformity you're after !

Uniformity... not only in the finished product but in the steel you make it from. And U·S·S Carilloy Alloy gear steels **assure it.**

• • •

AT best, the high-speed production of accurate gears is a tough job. Exacting for the gear manufacturer, exacting for the steel maker. For the cardinal requirement steel must fulfill for such applications is *unvarying uniformity*. And that doesn't "just happen".

In U·S·S Carilloy Alloy Steels we offer you gear steels in which correct physical, chemical and metallurgical properties are maintained from bar to bar, from heat to heat, shipment after shipment.

Here are steels consistently uniform, not only in ease of forging — in response to annealing—ease of machining and in response to heat treatment. But in Carilloy Steels uniformity has been extended to include a much less easily controlled effect — *distortion in heat treatment.*

To the gear manufacturer this is highly important, for upon it largely depends the accuracy of the finished gear.

Thus in heat treating gears of U·S·S Carilloy, the minimum amount of distortion that does occur is uniform from gear to gear and can be counted on to remain so, day after day. With procedure once established, the gears can be kept uniform, to close limits of accuracy, with least fabrication difficulties and minimum rejections.

This matter of dependable uniformity — characteristic of U·S·S Carilloy — is vital to every user of alloy steels.

We assure it by giving every alloy steel order individual care and control. Made to rigid specifications, produced in special alloy plants, by specialists who make alloy steels and nothing else, these made-to-measure steels assure you consistently economical fabrication, guarantee the reliable performance of your product in service.

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Allegheny Metal is immune to corrosive effects of weather

FABRICATION NEWS

Good for a Lifetime—Bri for an Age

FROM STAINLESS STEEL HEADQUARTERS—ALLEGHENY LUDLUM, OF COURSE!

1938 MARKED REAL PROGRESS I WELDABILITY OF STAINLESS STEEL

THE rapidly increasing use of the stainless steel alloys in structures fabricated by welding has been accompanied by a constantly increasing knowledge of the various processes of welding and of their effects on these alloys. This was particularly true in 1938.

The Allegheny Ludlum Steel Corporation recognized years ago in its pioneering days that the ultimate in the fabrication of welded structures was the preservation to the fullest possible extent of all the corrosion-resistant and physical properties inherent in Allegheny Ludlum alloys "as shipped from the mill"—those qualities that lead to the initial selection of an alloy for a given application.

Because of its important position as a producer of stainless alloys and because so large a proportion of its production goes to the ultimate user in welded condition, Allegheny Ludlum has continued to hold the lead in the study of the practical phases of welding as applied to these alloys. This has been accomplished through years of organized research and collaboration with fabricating customers.

Noteworthy among recent activities have been the following:—

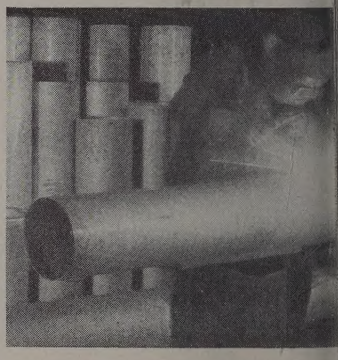
1. Investigation of the relationship between choice of alloys (stabilized or unstabilized), construction, methods of welding, and general size and design of the unit involved, together with consideration of the question as to whether or not to anneal for stress-relief or for carbide solution.

2. Effects of various compositions in the welding rod, so far as physical values are concerned, and the relation between these and the combined chromium and nickel contents.

3. The welding of the ferritic alloys wholly or in part with chrome-nickel alloy welding rods in the interest of ductility, and the use of this method on vessels intended for service in various temperature ranges.

The remarkable development of modern welding processes in recent years has been coincident with the development of the stainless steels. Alternately, the one development has provided an incentive to the other. They have developed together.

Allegheny Ludlum, therefore, stands ready to render thorough



technical assistance to users o alloy products on applications volving welding.

ALLEGHENY LUDLUM
STEEL CORPORATION
WAREHOUSE STOCKS
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"Steels of Today and Tomorrow

READER Comments

Readers are invited to comment upon articles, editorials, reports, prices or other editorial material appearing in STEEL. The editors cannot publish unsigned communications, but at their discretion may permit a writer to use a pseudonym when a bona fide reason exists for withholding his identity. Letters should be brief—preferably not exceeding 250 words.

ise Well Merited

he Editor:

raise accorded the collector of p metals by James S. Earle of bureau of mines recently be- the National Association of te Material Dealers at Chicago, EL, March 27, page 20) is well rved. The service of this branch ndustry is, as he said, the most tive contribution to conserva- of natural resources.

side from the scrap produced he steel mills and recycled and scrap byproduct of industrial ations, such as the canmaking automobile industries, an im- ant part of the tonnage is col- d by small dealers who handle erial gathered at the periphery the great pool. Without their k a tremendous tonnage would ost, left unreclaimed.

ften these collectors must risk r money in accumulating stocks time when prices are too low warrant them in selling, and t hold their accumulations un- turn of the market puts the e above the profit line. It is a -known phenomenon of the p market that every dollar rise price widens the circle from h reclaimed scrap can be ped to consuming centers. Con- ely every decline narrows the e.

hen it is considered that every of steel or iron scrap repre- s approximately two tons of ore, as well as coke and lime- e, it can be seen that every ton crap returned to the steel mill represents conservation of this quantity of raw material.

As a matter of fact, production of steel from scrap cuts out a considerable number of operations necessary in making it from iron ore, thus saving time and often giving a product requiring less refining.

In recent years the growth of the scrap industry to the stature of a real business has been marked by its internal efforts to govern itself and eradicate evils that had existed, putting it on a high plane. Formation of voluntary organizations, such as the Institute of Scrap Iron and Steel Inc., has done much to strengthen its position and it has become a leading member of the industries intimately connected with the production of steel.

BROKER.

Pittsburgh

Reason on Way Back

To the Editor:

Indications are that the worst is past in the matter of business badgering by hostile legislation fostered by extreme labor interests. Now that some of the restrictive laws are reaching the courts they are being thrown out and their utterly unfair character proved by legal scrutiny.

One of the most flagrant violations of business rights was the "Little New Deal" put over in the administration of Governor Earle of Pennsylvania. It provided such impossible conditions that business simply could not continue operation indefinitely. The court's opinion that its conditions were "grossly unfair" is putting the case mildly. Further clarification of the maximum rates of compensation is awaited, the court indicating a rule of reason should be applied in this.

It seems that the day of radical labor's roughshod ride over the rights of the remainder of the people has reached its end and that reason again will assert its sway. Signs indicate the pendulum is swinging the other way and that conditions will be improved as the unfairness and burdensome effects are brought into the open.

JOHN MOORE

Philadelphia

Steel Wage Level Helps

To the Editor:

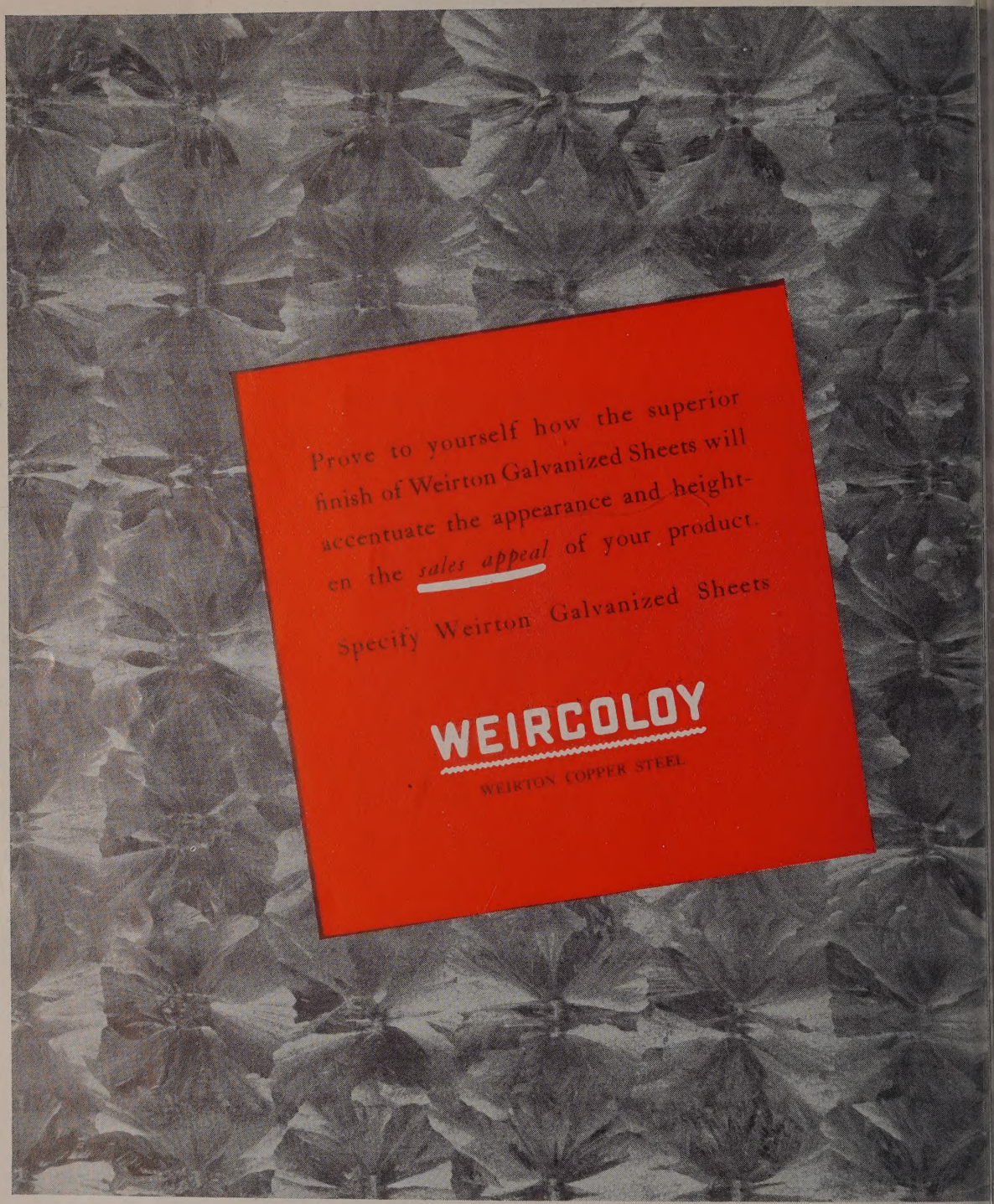
Critics of business relations with labor should find something to think about in the report of the American Iron and Steel institute on employment and wages, STEEL, April 3, page 19. With 453,000 employes in February, compared with 461,000 a year ago, the wage total was 25 per cent higher.

This increased payroll probably is one factor in the long list of companies reporting deficits in earnings. But the industry is doing its share to increase purchasing power and if volume of production were increased sufficiently there would be a profit for stockholders as well as for workers.

The steel industry certainly is doing its share to improve conditions and should be commended for it.

STEELWORKER

Youngstown, O.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ESTABLISHED 1882

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STEEL
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the Editor
ews the News

NSUMERS are suggesting (p. 15) that the steel ry might avoid extreme fluctuations in pro- n and employment by carrying floating inven- of standard items to offset irregularities in d. Advantages of further standardization, and g new prices effective immediately on announce- also are discussed. Producers point out that ous inventories would have to be carried, ask ners to anticipate requirements. . . . STEEL'S enth annual financial analysis (p. 34) shows a 6,841 net loss for 92.5 per cent of the industry 38. Total earnings were not enough to pay interest, and were less than one-fourth the in- 's tax bill. . . . United States Steel Corp.'s gement (p. 32) is hopeful for the immediate out- A stockholder suggests collective bargaining areholders as well as steelworkers.

• • •

every dollar railroads take in (p. 33) 9 cents aid for taxes, 23½ cents for maintaining road- Of every dollar taken in by motor carriers 4½ cents go for taxes, including gasoline tax and license fees, noth- ing for roadways. Inland water carriers pay only 2 cents for taxes, nothing for channels. . . . Aircraft try's $200,000,000 backlog (p. 27) is a new peak. Jan. 1 bookings have totaled $95,000,000. Pro- n for 1939 now is estimated at $225,000,000, r cent higher than last year. . . . Foundrymen stern meeting (p. 20) were urged to work more ssively for business now passing to other fabri- methods, and to establish closer relationship en producers and users of castings.

roads' len

• • •

vast amount of research in recent years has devoted to pure iron sponge or powder. A num- f important uses for iron powder now are pro- posed. STEEL (p. 43) reviews progress in this field to date. . . . Security and exchange commission (p. 26) has begun a study of the factors that prevent small business obtaining capital. A house bill would author- e department of commerce to spend $2,000,000 in business research. . . . Tennessee Coal, Iron & Railroad Co. (p. 26) will expand production of special shapes for use in prefabricated steel houses. Youngstown Sheet & Tube Co. (p. 75) is one of the sponsors of a new low-cost house of alloy steel construction. . . . Steel production (p. 19) again dropped 1 point last week to 53½ per cent of ingot capacity.

e Iron der

• • •

"New products and the training of workers to make them will solve the problem of unemployment." That is the belief of this week's contributor to STEEL's Forum on Re-Employment (p. 38), Charles H. Oppenheimer, president, Designers for Industry Inc. He cites numerous companies which have increased employment through new products. . . . Sales appeal of nameplates and many other metal parts (p. 40) is increased through decorative treatment of wide variety. . . . Cold rolling facilities at the Irvin works (p. 56) have capacity for strip ¼-inch thick and lighter, up to 77 inches wide, in coils to 54-inch outside diameter, or in sheets to 32 feet long. . . . Recent research work (p. 74) reveals a wide range of cases that may be had by compounding gases in dry cyaniding.

New Items, More Jobs

• • •

A fractional-horsepower motor plant (p. 62) is characterized by a unique materials handling system and by other features which promote manufacturing efficiency. . . . An unusual welded pot chuck weighs 96,200 pounds and is 33 feet 7 inches in outside diameter: it will slot teeth (p. 65) of forged internal gears which rotate 16-inch gun turrets on battleships. . . . Comprehensive tests (p. 70) show that the eye often is unreliable in choosing colors for large painted surfaces which are likely to affect illumination. Many times it is possible to select equally pleasing colors with a 10 to 15 per cent gain in reflecting value. . . . Interesting procedure has been developed at one plant (p. 66) in forming torpedo-type headlight shells of ultra-streamlined design.

96,200-Pound Pot Chuck

E C Kreutzberg

Valuable Data at No Extra Cost

Now you can be sure . . .

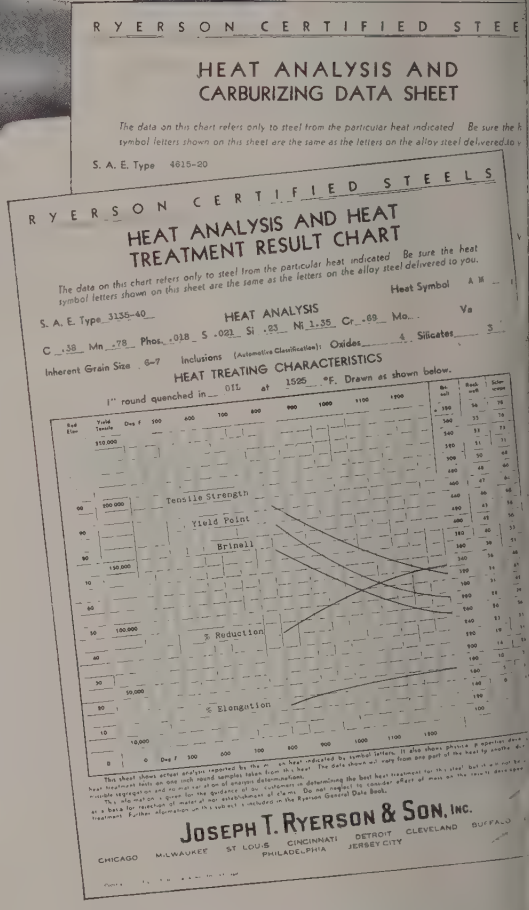
You can depend on better results in less time when your heat treater is guided by the Ryerson alloy data charts. These charts show him the exact properties of the steel with which he is working and show him how to get the desired results. He does not have to test. He takes no chances. Spoilage is eliminated and a sound dependable job of high accuracy and uniformity is assured.

In addition to saving in production costs, the Ryerson Certified Alloy Plan benefits the Purchasing Department, as they can keep a detailed record of the exact analysis of every alloy purchased. Thus it is possible to duplicate particularly desirable close range specifications on repeat orders.

The Metallurgical Department is benefitted for they can call for any reasonable physical requirement and be sure the Heat Treater can produce the required properties.

Ryerson Certified Steels also include carbon, tool and stainless steels that meet definite quality standards. They offer many advantages to steel users. Let us send you a booklet which tells the complete story.

Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.


RYERSON CERTIFIED STEELS

HEAT ANALYSIS AND HEAT TREATMENT RESULT CHART

The data on this chart refers only to steel from the particular heat indicated. Be sure the heat symbol letters shown on this sheet are the same as the letters on the alloy steel delivered to you.

S. A. E. Type 3135-40 HEAT ANALYSIS

C .38 Mn .78 Phos. .018 S .023 Si .23 Ni 1.35 Cr .69 Mo.

Inherent Grain Size 6-7 Inclusions (Automotive Classification): Oxides 4 Silicates 3

HEAT TREATING CHARACTERISTICS

1" round quenched in OIL at 1525 °F. Drawn as shown below.

Tensile Strength

Yield Point

Brinell

% Reduction

% Elongation

JOSEPH T. RYERSON & SON, INC.

CHICAGO MILWAUKEE ST. LOUIS CINCINNATI DETROIT CLEVELAND BUFFALO PHILADELPHIA JERSEY CITY

Special Ryerson Data Sheets

While two heats of an alloy steel may be almost identical in che analysis, one may be much more responsive to heat treatmen this reason, Ryerson data sheets show *actual* heat treatment re

Two types of data sheets are used, one for the carburizing which gives complete analysis and the results of carburizing. The other, which is for the higher carbon steels, shows quenching and drawing results. Both charts are accurate that help the heat treater save time in securing desired prop

RYERSON *Certified* STEEL

bilizing Production;

eel Grapples with

Major Problem

N the steel industry level nployment? This is a ques- which is receiving increasing ion from its management and has generated considerable ht on the part of the consum- dustries.

principal objective is the ation or smoothing out of clic business curve to the end general purchasing power will ore uniform as the result of m employment and compen- .

econdary objective is to place ndustry in the best possible on with reference to the tax n set up in the state unemploy- compensation laws.

t business generally is recog- the changing social order is ced by a statement of an of- of the National Association of facturers who recently urged ss men to adapt and maintain ces which would bring about and political evolution in line industrial evolution. Industry ly has taken many of the steps ct a more perfect social order, y no means has traversed the route.

ently it has been suggested by consumers that the steel indus- uld prevent to a large extent treme gyrations in production mployment by carrying float- nventories of standard items would tend to offset irregu- s in demand.

steel industry regularly pro- duces approximately 1200 different analyses of steel, each fabricated in a varying number of forms, with the result that the number of specifications runs into thousands. However, consumers point out that a considerable portion of these specifications are produced in so-called standard shapes and analyses. Carbon bars represent a good example. Supposing a steel mill had 2000 customers for ¼-inch 0.20 to 0.30 carbon rounds and sold an average of 20,000 tons per year. Consumers declare that under present practices, the mill will accumulate or pigeon-hole orders for this specification until sufficient tonnage is on the books to warrant a rolling. In the meantime, the first customers on the list find it necessary to wait five or six weeks for delivery on material for which there is often a pressing need.

Advocate Advance Rollings

It is suggested by consumers that this setup be reversed. The mill knows that barring an unforeseen business collapse it is likely to sell at least a large portion of the 20,000 tons of ¼-inch rounds. If it has found that it can produce these bars most economically in lots of 1000 tons, it is proposed that it roll this tonnage in advance rather than wait for individual orders to pile up to this amount.

In this way, the consumer would not be inconvenienced and the steel could be rolled in periods of comparative slackness. This plan presented by consumers does not propose completely to level out steel industry employment, but merely to smooth off some of the peaks, since it would be folly to stock items ordered infrequently. It is pointed out that had the plan been followed in 1938, as an example, monthly average operating rates would not have fluctuated between a low of 28 per cent in June and a high of 62 per cent in October.

In 1938 the steel industry suffered from the reaction to the activity of 1936 and 1937, but it could be fairly well assured that sooner or later demand would pick up considerably. Had it turned out standard items for its floating inventory during the early part of the year at a rate of around 35 per cent of capacity, the October peak might have leveled off to around 45 per cent.

Now as to consumer views regarding the extreme peaks in production which occur following announcement of a price advance: It is pointed out that in the spring of 1937, for instance, steelmaking topped the 90 per cent mark as the result of an announcement of higher prices. Subsequently operations dropped to 25 per cent.

It is felt that this could have been prevented by building up its floating inventories to a fairly high level prior to the advance which would have meant less strain on production to make deliveries. The subsequent decline in steelmaking activi-

ty in 1937 could have been made less precipitous by again replenishing inventories depleted by the unusual demand which accompanied the price advance.

It also is suggested that producers could help to avoid artificial bulges and declines in production by making effective dates of price advances simultaneous with announcements of such advances, instead of allowing weeks or months to intervene as at present.

A number of leading steel purchasers think the plan offers other definite advantages. If the mills maintain floating inventories of standard items, they can offer improved deliveries on specialty items which must be produced to order and often in relatively small quantities. A more even operation is likely to result in lower costs because of diminished strain on men and equipment, along with production of more economical "unit" tonnages.

Of course, consumers admit that the steel industry cannot fully stabilize employment itself since it is subject to the whims of consumers. But, among some consumers there is a tendency to standardize on analyses. For instance, a consumer of alloy bars has found he can use one in place of the previous four.

Rail Mills Handicapped

Standardization is one answer to the problem. A leading steel company executive points out that the railroads, as an example, have widely varying specifications for rails. Some roads even specify different rails for their several divisions. This means that rail mills cannot roll ahead in anticipation of railroads' requirements, but must wait until the actual orders are on the books.

Tin plate represents another example to which the principle of standardization might be applied and which might be produced ahead in anticipation of consumer requirements. While some variation in plate is necessary, depending upon the product packed, it is felt that many of the present varying requirements in finish and physical requirements are superfluous.

Many industries must adjust their buying practices to a more co-operative basis before the steel industry can effect desired adjustments in its operating schedules. This especially applies to the consumer goods industries, such as automotive. The latter often places large tonnages ranging from 25,000 to 100,000 tons, but no mill has the assurance that it will get part of the business. When the order finally is distributed delivery is requested for "the day after tomorrow." All this results in bulges in production which many in the steel trade feel could be avoided were the automobile industry to revise its steel buying policies in line with assembly schedules, adjusted in easy stages to conform to consumer requirements.

The automobile industry is typical of the increasing problem presented by the consumer goods industries whose requirements vary seasonally. An examination of production statistics reveals seasonal variations have been strongly accentuated in the

Details of Steel Employment, Hours, Wages Since

	Employes receiving hourly, piecework or tonnage wages						
1933	Number employes	Total hours worked	Average hrs. per week per employe	Total wages (dollars)	Average earnings per hr. (cts.)	Total wage, salary employes	pa (d
June	305,239	51,645,321	39.4	24,441,054	47.3	338,146	30.5
Sept.	380,271	52,252,033	32.0	29,608,107	56.7	417,020	37.2
Oct.	378,862	52,308,897	31.2	30,291,985	57.9	416,277	38.3
Nov.	362,206	43,044,055	27.8	24,838,494	57.7	399.569	32.6
Dec.	357,424	45,736,252	28.9	26,439,830	57.8	394,943	34.3
1934							
Jan.	355,292	45,898,885	29.2	26,737,393	58.3	393,013	34.8
Feb.	365,305	46,655,614	31.9	27,394,221	58.7	403,298	35.4
March	380,471	56,047,913	33.3	33,010,060	58.9	419,277	41.2
April	392,069	56,723,813	33.7	36,778,026	64.8	431,086	45.4
May	409,698	66,450,593	36.6	42,916,172	64.6	449,362	51.8
June	415,547	63,589,289	35.7	40,630,314	63.9	455,966	49.4
July	383,673	41,381,779	24.4	26,150,272	63.2	424,126	34.9
Aug.	364,583	40,447,674	25.0	25,691,520	63.5	404,793	34.3
Sept.	343,064	33,203,234	22.6	21,244,286	64.0	381,828	29.1
Oct.	342,772	38,621,836	25.4	24,699,063	64.0	381,431	32.7
Nov.	343,219	38,793,790	26.3	25,082,162	64.7	381,663	32.9
Dec.	347,872	42,137,923	27.4	27,410,206	65.0	386,345	35.3
Total	369,845	569,093,876	29.5	357,293,012	62.8	409,349	457,8
1935							
Jan.	368,095	54,783,373	33.6	35,879,072	65.5	407,071	44.3
Feb.	381,010	54,221,180	35.6	35,652,577	65.8	420,397	44.2
March	385,506	57,882,810	33.9	38,053,190	65.7	425,189	46.7
April	384,546	56,368,953	34.2	37,174,010	65.9	424,623	45.8
May	381,303	57,326,908	33.9	37,529,522	65.5	421,470	46.4
June	376,431	50,777,987	31.4	33,080,422	65.1	416,732	41.9
July	375,348	52,309,007	31.5	33,855,040	64.7	415,937	42,7
Aug.	383,090	59,405,552	35.0	38,842,086	65.4	423,925	47.8
Sept.	387,924	56,485,479	34.0	36,863,891	65.3	429,217	45.8
Oct.	395,222	64,504,137	36.8	42,190,687	65.4	436,554	51.4
Nov.	396,949	60,819,820	35.7	40,027,160	65.8	438,370	49.7
Dec.	408,510	63,095,080	35.0	41,383,845	65.6	451,810	51.6
Total	385,328	687,979,926	34.2	450,531,502	65.5	425,941	557,7
1936							
Jan.	410,613	67,323,251	37.0	43,924,635	65.2	453,964	53,7
Feb.	408,976	62,310,069	36.8	40,496 550	65.0	452,649	50,2
March	413,645	67,850,000	37.2	44,477,510	65.6	458,070	54,3
April	434 594	76,244,541	40.9	49,911,816	65.5	480,119	60,1
May	455,765	79,890,221	40.5	52,291,495	65.5	491,864	62,7
June	451,299	78,989,190	40.8	52,522 262	66.5	498,243	62,9
July	467,065	80,526,023	39.0	53,823,890	66.8	514,742	64,4
Aug.	472 851	83,111,766	39.7	55,204,695	66.4	522,369	66,3
Sept.	476,593	82,656,665	40.5	54,480,950	65.9	526,717	65,6
Oct.	480,790	90,604,687	42.5	59,650 455	65.8	531,358	71,1
Nov.	478,108	83,473,936	40.7	57,652,243	69.1	529,208	69,2
Dec.	485,236	89,066,999	41.5	64,439,010	72.3	537,147	76,8
Total	452,128	942,047,348	39.8	628,875,511	66.8	499,704	758,0
1937							
Jan.	495,559	88,905,739	40.5	64.031,845	72.0	547,997	76 4
Feb.	502,688	85,502,314	42.5	61,765,546	72.2	556,077	74,2
March	520,487	98,100,014	42.5	77,278,240	78.8	577,050	90,8
April	530,098	93,979,207	41.3	79,885,171	85.0	589,351	94,3
May	533,550	91,194,218	38.6	78,382,248	86.0	595,354	92,9
June	495,260	83.391,779	39.2	72,582,963	87.0	555,743	87,5
July	532,694	87,769,974	37.3	75,661,847	86.2	593,906	90,5
Aug.	541,004	90,810,261	37.9	77,570.340	85.4	603 106	92,6
Sept.	540,389	85,011,778	36.8	71,140,268	83.7	602,729	86,1
Oct.	524,837	74 271,018	31.9	61,242,513	82.5	586,644	76,1
Nov.	490,238	57,939,478	27.6	47,213,654	81.5	551,158	62,1
Dec.	448,504	46,472,266	23.4	37,966,458	81.7	507.814	52,0
Total	512,942	983,348,046	36.8	804,721,093	81.8	572,244	976,08
1938							
Jan.	416,241	42,209,263	22.9	33.974.000	80.5	474.759	47,5
Feb.	402,750	40,128,200	24.9	32,618,070	81.3	460,617	45,5
March	397,538	47,057,185	26.7	38,499,749	81.8	454 997	51,3
April	387,650	42,490,753	25.6	35,096,911	82.6	444,781	47,8
May	378,680	40,907,993	24.4	34,189,756	83.6	435,589	46,7
June	368,239	40,380,352	25.6	34,125,126	84.5	424,703	46,7
July	368,003	39,446,563	24.3	33,442,475	84.8	424.354	45,8
Aug.	371,030	48,362,994	29.4	40,226,308	83.2	426,892	52,7
Sept.	375,400	48.271,926	30.0	40,054,206	83.0	430,882	52,3
Oct.	380,652	52,620,518	31.2	43,766,299	83.2	435,929	56,1
Nov.	394,832	57,884,241	34.2	48,357,224	83.5	450.244	61,0
Dec.	393,541	55,717,003	32.0	46,503,822	83.5	449,122	59,2
Total	386,213	555,476,991	27.6	460,853,946	83.0	442,739	613,19
1939							
Jan.	394,312	55,975,873	32.0	46,238,606	82.6	450,606	59,3
Feb.	396,495	53,109,307	33.5	43,897,977	82.7	452,872	57,0

Figures from American Iron and Steel institute.

or ten years and are apparent- to the rapid rise of consumer s, which in addition to auto- es include containers, refrig- s and thousands of light met- ecialty products.

s has been coupled with a ng inclination on the part of buyers to place orders only hand-to-mouth basis which s that steel required for peak ction periods, usually spring all, is bought during those pe- rather than in between when ries and service are better. situation is accentuated at the of a price rise when consumers ible to cover on requirements.

Cites Major Difficulties

executive of one important company analyzes the problem llows:

o one would dispute the bene- o public, employes and steel anies that would follow the ng out of the steel produc- curve, but in an attempt to about this condition by op- ng steel plants at a uniform to be determined in advance, illing peak demands from inven- s accumulated during periods demand is slack, two chief ulties appear.

The establishing of a produc- level to be maintained for a period would necessitate long-range prediction of steel requirements. In times like the present it would take considerable courage to predict demand for a year ahead, determine the rate of operation needed to meet that anticipated total demand, and then adopt an operating rate based on that prediction.

"2. Enormous inventories would be needed, involving very heavy added cost for steel producers. The fact that demands are constantly shifting, plus the fact that there are nearly an infinite number of possible variations in steel products today—variations in both size and in analysis—would call for very large stocks, if orders were to be filled from materials on hand. The growing tendency toward 'tailor-made steels' is a major complicating factor in the inventory phase of the problem.

"One first practical step that would help to level out production would be for customers to anticipate their requirements as far as possible. Take the buyer who buys about 25 tons of a certain type of steel four times a year, and has to wait four or five weeks for delivery. If only he could anticipate his needs —and very possibly he could, as his requirements for this steel recur so uniformly—he would avoid the inconvenience he now suffers through delay, and the problem of the mill would be to that extent simplified."

That the steel industry already has made progress in partially leveling the peaks in employment may be readily seen by referring to the accompanying chart. It will be noted that the sharp swings in steel production are not closely accompanied by the trend in number of workers employed. The payroll trend is more closely in line, but even so does not fluctuate closely with production.

The tendency of the steel industry to absorb higher labor costs during periods of slow business dates back to the beginning of the depression when the share-the-work movement, which preceded NRA, gave at least a partial income to the bulk of the steel workers, in contrast to the previous practice of wholesale layoffs. This plan gave some employment to 75,000 employes of one large steel company, who otherwise would not have been employed.

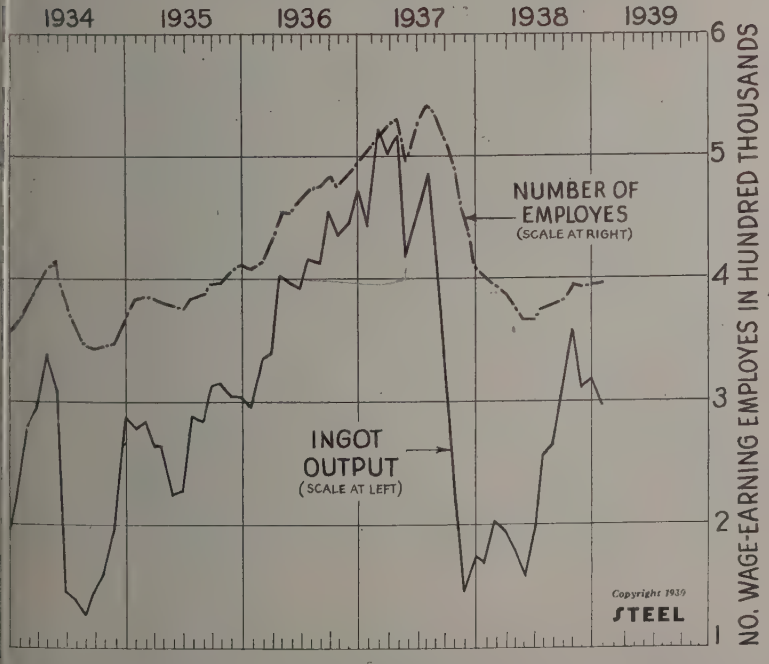
Wages at Record High

The move to share available work as much as possible has been accompanied by a sharp increase in wage rates. At the turn of the century the rate for common labor was 12 to 15 cents an hour, but today the base is at an all-time high of 62½ cents. This is due to the present highly-mechanized state of the industry which means that it requires a large amount of skilled labor and comparatively little unskilled labor.

"Sooner or later the steel industry will find it necessary to level out employment, either because of legislation or otherwise, but the industry cannot work out any plan without the wholehearted co-operation of the consuming industries," said a steel executive.

"The industry can and does build up inventories of certain standard items in slack times, but it cannot stock most other products."

Ups and Downs in Output, Employment



teel ingot production has fluctuated sharply in the past five years, from 1,268,- gross tons in September, 1934, to 5,218,326 tons in March, 1937. Variations n number of wage earners employed have been, by comparison, less severe

Republic Steel To Modernize Berger Plant

■ An extensive modernization and equipment re-arrangement program which will completely revamp production facilities is being started at Republic Steel Corp.'s Berger manufacturing division, Canton, O.

Installation of new presses, conveyor oven equipment, new conveyor lines and new air conditioned rooms for painting will result in an improved flow of material and quality.

The modernization program has been made necessary in part by increase in demand for new products, including library equipment.

Industry Substantially Mobilized For Emergency, Says War Secretary

■ INDUSTRY'S co-operation in the national defense program received warm praise from Col. Louis Johnson, acting secretary of war, speaking before a dinner of the American Conference on National Defense in New York, April 5.

Colonel Johnson told the 1200 attending that industry now is substantially mobilized for a possible war emergency. Supplies of raw materials required from foreign sources have been or are being accumulated.

"We depend," he said, "on foreign sources for 99 per cent of our chromium, 95 per cent of our high grade manganese, 50 per cent of our tungsten, 95 per cent of our rubber, and practically all of our tin."

While the war department has urged stockpiles of these strategic materials for years, it was not until the Munich conference that the acute need for such materials became generally apparent. The war department lacked funds to acquire the stockpiles, turned to industry for help.

"We called a conference of those who used chromium and explained the situation. Immediately, they responded. One corporation, to my knowledge, went out into the open market and bought enough chromium to tide over its need for a period of three years.

"We told a group of industrialists of the likely shortage of manganese and the greatest American producers of ferromanganese began to build up their stocks.

"When we informed industry of our needs in tungsten, it intensified the development and the production of this mineral in our own country and added considerably to our annual output.

Developing Rubber Substitute

"When we pointed out our needs in rubber, industry intensified its efforts, at great expense, toward the production of a substitute. I am sure you will all be interested to learn that there is every indication of success in this significant experiment.

"When we advised industry of our requirements in tin, it lent its energy toward the development of a nickel plated can which today gives every promise of replacing tin for all purposes and at no greater cost."

Since September, when the power industry was asked to start construction of at least 1,000,000 kilowatts of additional capacity, 900,000 kilowatts have been installed or are in order, Colonel Johnson said.

The nation now has sufficient supplies on hand to carry an initial army of 400,000 through the first six months. During such a 6-month period, the colonel said, industry as now organized could start mass production of all but 55 of the 7000 items needed by the war department in an emergency. Educational orders soon will be placed to take some of the 55 items off the "not available" list.

Rear Admiral Clark H. Woodward and Col. Frederick H. Payne, vice chairman, American Conference on National Defense, were other speakers at the dinner.

Incidental to the preparedness dinner, the Wire association held a regional meeting in New York, April 5, inspecting the signal section, army base, Brooklyn. Most members attended the national defense dinner.

SCRAP INSTITUTE OFFERS GOVERNMENT CO-OPERATION

WASHINGTON

Institute of Scrap Iron and Steel's war service committee met here last Friday to initiate a gram to tie the industry's fa in with the army and navy dustrial mobilization plan.

Although scrap iron and ste not included in the list of str and critical materials, of whi government is proposing to ac late stocks, the industry is p ing to co-operate to assure ar quate supply.

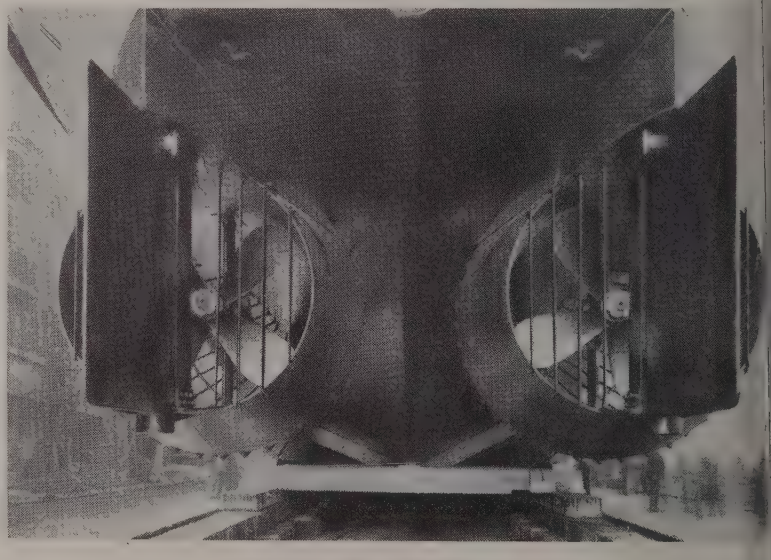
Survey of available stocks complete analysis of steel mil foundry scrap requirements w undertaken promptly by the tute's war service committe conjunction with the presiden its 19 chapters.

"Present visible supplies an serves of scrap are ample to up any sudden strain occasion a possible sharp rise in the ra steel production in event o emergency," said E. C. Barringe stitute's executive secretary. "M while, an increase in the cons tion of steel would automat expand the production of scrap augment the present visible ply."

The committee also confe with the planning branch of army and navy munitions boar

■ Orders received by General tric Co. in the first quarter am ed to $86,882,953, compared $65,376,400 for the correspon period in 1938, an increase o per cent.

Welded Construction on Tug for Working in Ic



■ Arc welding was used extensively by Canadian Vickers Ltd., Montreal, constructing this towing tug, designed for working in ice. Kort nozzles w built integrally with the ship's hull around each propeller, giving effective prot tion. Incorporated in the nozzle structure are twin Oertz streamline rudders, ranged to permit convenient removal of propellers and tailshafts. Photo, court Wilson Welder & Metals Co., New York

ot Rate 55.6
Cent in March

EL ingot production in totaled 3,364,877 gross tons, monthly output this year, eeding that of any month in cept November, when 3,572,- s were made, according to nerican Iron and Steel insti-

quarter output amounted to 4 tons, 75 per cent more n the first quarter of 1938, ly 3 per cent less than in the quarter last year.

h operating rate was 55.63 nt of capacity, against 54.10 nt in February and 33.85 per t March, 1938. First quarter ions averaged 54.14 per cent, red with 55.77 per cent in quarter and 31.58 per cent quarter last year.

age weekly production was tons in March, 738,721 tons bruary and 454,268 tons in 1938. For first quarter this he weekly average was 739,- ns, compared with 748,350 or fourth quarter and 423,709 or first quarter last year.

L Extends Inspection eamless Drill Pipe

es & Laughlin Steel Corp., rgh, has adopted two pro-cedures for inspecting its integral joint seamless drill pipe. They include the use of a new instrument called the Tube-wall-scope to examine interior surfaces. A new application of the Magnaflux method is being used on tube exteriors.

The Tube-wall-scope is an optical instrument which is pushed through the pipe. A strong light, reflectors and lenses enable the operator to see the interior highly magnified, and to locate defects. Every length of drill pipe is now subjected to the two tests in addition to the usual inspections.

■ With a backlog of orders totaling $925,000, mainly for jail equipment, Van Dorn Iron Works Co., Cleveland, will continue 100 per cent activity for at least six months.

District Steel Rates

Percentage of Ingot Capacity Engaged In Leading Districts

	Week ended April 8	Change	Same week 1938	Same week 1937
Pittsburgh ...	49	None	29	95
Chicago	53.5	None	31	84
Eastern Pa....	40	None	28	59.5
Youngstown..	48	— 2	33	87
Wheeling	66	None	33	96
Cleveland	52.5	None	27	74
Buffalo	44.5	+ 2.5	28	88
Birmingham..	62	None	66	80
New England.	35	—15	20	95
Cincinnati ...	44	— 7	45	90
St. Louis	42	— 1	42.4	82
Detroit	69	— 5	18	100
Average....	53.5	— 1	32	91.5

Steel Ingot Statistics

Monthly Production—Complete for Bessemer; Open Hearth, Calculated from Reports of Companies Making 98.26 per cent in 1937

	—Open Hearth— Gross tons	Per cent of capacity	—Bessemer— Gross tons	Per cent of capacity	— Total — Gross tons	Per cent of capacity	Weekly production, all companies, gross tons	Number of weeks in month
....	3,039,340	55.19	147,494	27.24	3,186,834	52.69	719,376	4.43
....	2,758,697	55.48	196,186	40.12	2,954,883	54.10	738,721	4.00
....	3,170,183	57.56	194,694	35.95	3,364,877	55.63	759,566	4.43
....	8,968,220	56.10	538,374	34.25	9,506,594	54.14	739,237	12.86
....	1,632,773	30.25	99,991	18.27	1,732,764	29.15	391,143	4.43
....	1,578,233	32.38	125,493	25.40	1,703,726	31.74	425,931	4.00
....	1,854,669	34.36	157,737	28.83	2,012,406	33.85	454,268	4.43
....	5,065,675	32.33	383,221	24.13	5,448,896	31.58	423,709	12.86
....	1,793,522	34.31	131,644	24.84	1,925,166	33.44	448,757	4.29
....	1,676,215	31.06	130,590	23.87	1,806,805	30.39	407,857	4.43
....	1,519,589	29.07	118,688	22.40	1,638,277	28.46	381,883	4.29
....	1,854,076	34.43	127,982	23.44	1,982,058	33.42	448,429	4.42
....	2,350,199	43 54	196,789	35.97	2,546,988	42.85	574,941	4.43
....	2,449,861	46.98	207,887	39.32	2,657,748	46.28	620,969	4.28
....	2,894,726	53.63	223,208	40.79	3,117,934	52.45	703,823	4.43
....	3,370,974	64.50	201,246	37.98	3,572,220	62.05	832,685	4.29
....	2,984,204	55.42	158,965	29.12	3,143,169	53.00	711,124	4.42
...	25,959,041	40.86	1,880,220	29.20	27,839,261	39.79	533,933	52.14

centages of capacity operated for 1939 are calculated on weekly capacities of 1,243,153 gross en-hearth ingots and 122,248 gross tons bessemer ingots; total, 1,365,401 gross tons; based al capacities as of Dec. 31, 1938, as follows: Open-hearth ingots, 64,817,994 gross tons; r ingots, 6,374,000 gross tons.
centages of capacity operated for 1938 are calculated on weekly capacities of 1,218,342 ns of open-hearth ingots and 123,514 gross tons of bessemer ingots, total 1,341,856 gross ased on annual capacities as of Dec. 31, 1937, as follows: Open-hearth ingots, 63,524,356 ns; bessemer ingots, 6,440,000 gross tons.

PRODUCTION

■ STEELWORKS operations last week declined 1 point to 53.5 per cent. Reductions were noted in five districts, an advance in one, and six were unchanged. A year ago the rate was 32 per cent, two years ago 91.5 per cent.

Youngstown, O.—Loss of 2 points to 48 per cent resulted from lower bessemer production, 42 open hearths continuing activity. Schedules for this week indicate further decline of 2 or 3 points.

Cleveland—All producers held operations steady, rate holding at 52.5 per cent for third consecutive week.

Chicago—Unchanged at 53.5 per cent, reduced activity by three producers balanced by increases by two others.

St. Louis—Declined 1 point to 42 per cent, with most plants at unchanged rate.

Cincinnati—Dropped 7 points to 44 per cent. Indications are for resumption of one or two open hearths this week.

Birmingham, Ala.—Steady at 62 per cent with 13 open hearths active.

Buffalo—Increased 2.5 points to 44.5 per cent, as Bethlehem lighted two additional open hearths at Lackawanna plant.

Pittsburgh—Held at 49 per cent, with indications for the same rate this week.

Wheeling—Continued at 66 per cent with the same rate probable for this week.

Detroit—Four open hearths were taken off at midweek, reducing the rate 5 points to 69 per cent, the lowest since September. On the present basis operations this week will be down 10 points more, to 59 per cent.

New England—Receded 15 points to 35 per cent, the lowest in more than a year.

Central eastern seaboard—Continued at 40 per cent, with no indication of immediate change.

Canadian Output Lower

■ Canada's production of steel ingots, castings and pig iron in February was less than in January, 1939, and February, 1938. Two months' output this year was below that of the corresponding period a year ago.

Gross Tons

	Steel ingots, castings	Pig iron	Ferro-alloys
Feb., 1939.....	77,179	41,333	5,299
Jan., 1939.....	78,198	57,660	2,855
Feb., 1938.....	98,980	61,000	4,436
Two months, 1939	155,377	98,993	5,154
Two months, 1938	211,360	136,309	9,933

Eastern Founders Discuss Problems; Producer-Consumer Unity Urged

■ DETERMINED effort is being made by the foundry industry to obtain its rightful share in steel and iron tonnage, Marshall Post, president, American Foundrymen's association, Chicago, told castings makers at a regional meeting at New Brunswick, N. J., April 1. As an example, he pointed out that castings now are being used by the automotive industry in ways not heretofore considered expedient.

The conference was the first sponsored by the Philadelphia and Metropolitan New York-New Jersey chapters, in co-operation with the mechanical engineering department, Rutgers university. It was promoted under direction of H. L. Henszey, Carborundum Co., Philadelphia, and Don Reese, International Nickel Co., Bayonne, N. J., heads of the Philadelphia and New York-New Jersey chapters, respectively. More than 200 attended.

Edwin C. Barringer, executive secretary, Institute of Scrap Iron and Steel Inc., New York, made the feature address at the dinner, which was presided over by Mr. Post. He said unfair implications have been read into the purchase of American pig iron, scrap, finished steel and rolling mill equipment by foreign nations.

"Metals of Peace"

"The assumption that these metals are entirely for war purposes is erroneous, because abroad, as at home, iron and steel, including castings, are inherently metals of peace and vehicles of a high standard of living."

He pointed out that the entire tonnage for the present American naval expansion program, which will take three and a half years to complete, could be rolled at the Gary, Ind., plant of Carnegie-Illinois Steel Corp. in a little more than one turn, if all plant facilities were concentrated on such an order. He contended that armaments in themselves, citing various examples, took a surprisingly small steel tonnage.

Discussing trends in scrap, he said the broadening range in alloy steels accentuates the scrap segregation problem, and the time is approaching when this will demand consideration by both seller and consumer. Due to increasing trend toward light consumer goods, potential scrap supply for foundries is diminishing, though he did not imply a marked shortage is imminent.

W. G. Reichert, Singer Mfg. Co., Elizabeth, N. J., addressing the technical session on "Castings Defects as Affected by Sand," suggested the importance of investigating and classifying the cause of all complaints, whether due to sand, metal, molding or gating arrangement, and of maintaining records of losses and correlating them with test data, with responsibility definitely centralized. Plotting curves of permeability, strength and moisture against scrap losses caused by sand, such as blows, drops, stickers, rough, and cuts, also proves valuable.

Molding Control Stressed

Sand with a suitable grain structure should be selected and used as a base for the variables, such as permeability, strength, and the fines which accumulate in the heap. Importance of moisture in controlling the gas content of the mold and in reducing blows was stressed.

Mr. Reichert stated a soft mold, resulting in an over-weight casting, swells, and strains, may be caused by increase in moisture or fineness of sand or decrease of strength. On the other hand, a hard mold under standard ramming conditions may be caused by increase in strength or decrease in moisture and fineness, and its most common defects are blows and scabs.

Deformation, according to the speaker, is important as a controlling factor in regulating green sand crush and in preventing drops, if flasks or bars in the mold distort slightly under compression loads.

Slides illustrated effect of grain distribution and fine and coarse additions to a standard sand. Fine grains, it was indicated, often cause a drop of 50 per cent in permeability and as much as 3 per cent coarse sand addition is necessary to cause permeability increase. It was evidenced by this and other effects that satisfactory grain structure and an open sand can be assured only by controlling the fines.

Practical methods were discussed for removing the fines, such as cyclone separation, air washing, exhausting by a fan and by sieving.

Mr. Reichert illustrated results of molding sands at elevated temperatures, particularly the effect on permeability, expansion and contraction. Decrease of permeability at elevated temperature, he said, is due to expansion of gases and to a lesser extent to gases from combustion of carbonaceous material in the sand. Expansion and contraction are important as far as they are definitely found to be the gateway to the cause and remedy for crushing, buckling, rat-tails and scabs. Slides illustrated these defects and demonstrated how conditions could be remedied by additions of mo materials.

He stated the best type of would give poor results unless ing design and position of run

(*Please turn to Page* 84)

Mill Castings Thrown Overboard in Atlantic Ga

■ Part of this trainload of rolling mill equipment, shown leaving the Homest Pa., plant of Mesta Machine Co., now lies on the bottom of the Atlantic. The eq ment for John Summers & Sons Ltd., England, was shipped aboard the BEL at Baltimore recently. In mid-ocean the ship ran into a heavy storm and 125 of heavy castings which had shifted on the deck, causing a perilous list, w thrown overboard. The castings will be replaced and sent over with later signments on the same order

IANCIAL

ELAND-CLIFFS PROFIT CED BY LEAN ORE YEAR

EVELAND-CLIFFS IRON CO., and, reports net profit for as $755,759, equal to $1.55 per red share, compared with $5,-3, or $10.30 a preferred share 7. No dividends were declared eferred stock in 1938. Arrear-n preferred stock were $28.16 e at year's end.

pany reported 1938 was the l worst year since 1900 in vol-Ore shipments dropped 68.7 nt from 1937, which was the l best year since 1900.

management expressed its 1939 will be a better year in volume and earnings than but far below 1937. Iron ore at lower lake docks and fur-will be approximately 12,000,-ns less than last year at navi-n season's opening, it was esti-

fs Corp., which owns all out-ing common shares of Cleve-Cliffs Iron and other invest-s, shows income from dividends 38 of $261,254, against $837,-n 1937. Directors declared a nd of 10 cents payable April record of April 10.

IONAL STEEL FILES ISSUE WITH SEC

tional Steel Corp., Pittsburgh, iled with the SEC a registration nent covering $65,000,000 of se-es, including $50,000,000 first eral mortgage bonds, due April 55, and $15,000,000 serial notes April 1, 1940-1949. Proceeds will plied as follows: $49,350,000 to mption at 105 and interest of 0,000 of the 4 per cent series s; $9,917,000 to redemption at and interest of $9,400,000 of per cent bonds. The balance treasury funds will be advanced reat Lakes Steel Corp., Detroit, ischarge of a $5,000,000 expan-obligation. Principal under-rs are the Kuhn, Loeb & Co., iman, Ripley & Co. Inc., White. & Co., and Lee Higginson

AND HOLDERS APPROVE SON & BENNETT PURCHASE

land Steel Co. stockholders have oved plan to acquire Wilson & nett Mfg. Co., Chicago, makers teel drums, barrels and other ainers, through exchange of 45,-Inland shares for all issued Wil-& Bennett stock. Stockholders approved issuance of 50,000 ad-nal Inland shares no par stock.

♦

thur G. McKee & Co., Cleve-, report 1938 net profit was 770, highest on record. This was equal to $7.45 per share on B stock and compares with $401,876 or $4.89 per share, in 1937. Dividends paid in 1938 were $4 a share, against $3.75 in 1937. Four-fifths of new business in 1938 was from the petroleum refining industry; in 1937, two-thirds came from the iron and steel industry. Foreign contracts accounted for 90 per cent of new business; normally domestic contracts account for more than half the total.

♦

Woodward Iron Co., Woodward, Ala., reports net profit of $180,121, equal to 66 cents a share on capital stock, for first quarter. This compares with a net profit of $287,390, or $1.06 a share, in the March quarter last year.

MEETINGS

A.I.S.E. TO INSPECT COKE, BLAST FURNACE PLANT

■ DETROIT section, Association of Iron and Steel Engineers, will sponsor a national meeting April 19 to inspect the blast furnace and coke plant recently completed by Great Lakes Steel Corp. at Ecorse, Mich. An invitation has been extended to both the Eastern and the Western States Blast Furnace and Coke Oven associations.

In the evening a technical program will be presented in the Fort Shelby hotel, Detroit, for consideration of the following papers: "Design and Construction of the New Blast Furnaces at Great Lakes Steel Corp.," by Raymond M. Hughes, assistant chief engineer, and William J. Rees, mechanical engineer, Great Lakes Steel Corp.; "Design and Construction of the New Coke Plant at Great Lakes Steel Corp.," by Charles P. Betz, superintendent, coke plant, Hanna Furnace division, and Phillip C. Vetter, engineer, Great Lakes Steel Corp.

WAREHOUSE ASSOCIATION TO MEET IN CHICAGO, MAY 16-17

American Steel Warehouse Association Inc. will hold its thirtieth annual convention May 16-17 at the Drake hotel, Chicago. The first day will be devoted largely to conferences, with a business session at 2 o'clock. The annual business meeting will be at 10 o'clock the second day, with a further session in the afternoon and the annual banquet at 8.

NATIONAL METAL TRADES' FORTY-FIRST CONVENTION

National Metal Trades association will hold its forty-first annual convention at the Palmer House, Chicago, May 24-25. Industrial relations problems will be discussed.

Sales Promotion, Way to Profits

■ SALES promotion is one of the two means left by which business management can protect its slender but vital 4 per cent profit margin, declared J. H. Van Deventer, editor, *The Iron Age*, to Industrial Marketers of Cleveland, in that city, last Friday.

He pointed out control of taxes, wages and hours, overtime and material costs has been taken out of management's hands by government and labor unions. Remaining to management are only control of productivity per man hour and volume of business.

Mr. Van Deventer praised business for its handling of productivity per man hour. Management has not done so well with sales promotion, he said.

"I am sure you all know about the break-even point. It is the point at which a shrinkage in sales volume will dip you into the red and an increase in volume will turn the profit and loss figures black. It is a critical and significant point . . .

"That is the time your promotion efforts should be doubled and redoubled. That is the time when modern sales promotion, by increasing volume even a little, will pay big dividends in increased profits or decreased losses."

The speaker likened sales promotion to mechanized sales effort; personal selling to skilled handwork. Personal selling, he said, is limited as to expansion of effort, the good salesman now being loaded to top capacity.

"Promotional sales effort, like modern production machinery, is unlimited as to capacity. You can speed it up 10, 20, 100 or 1000 per cent over night."

Mr. Van Deventer was introduced to the group, numbering about 1000, by E. L. Shaner, editor-in-chief, STEEL.

Industrial Building Costs Below 25-Year Average

■ Industrial building costs during first quarter 1939 were 8 per cent below the 25-year average, according to a cost chart compiled by The Austin Co., Cleveland. Chart records the average cost per square foot of one-story daylight plant construction.

Current cost is $1.40 per square foot, compared to a 25-year average of $1.52. It compares with a record high of $2.67 in spring of 1921 and a depression low of $1.08 during the first half of 1933.

MEN OF INDUSTRY

■ C. I. AUTEN has been appointed manager of sales, cold formed steel division, Tennessee Coal, Iron & Railroad Co., Birmingham, Ala. Mr. Auten will direct sales activity pertaining to the use of cold formed steel products in eight southeastern states, with emphasis upon materials for prefabricated steel houses and farm buildings. Since joining the company in March, 1938, Mr. Auten has been engaged in co-ordinating developments of steel for new purposes, and has directed its activities in co-operation with farm security administration engineers to develop prefabricated steel buildings recently erected by the company for the federal agency.

In 1936 Mr. Auten resigned as vice president, Truscon Steel Co., Youngstown, O., spending the ensuing two years in Orlando, Fla.

C. M. McKenna, a sales engineer, has been named assistant to Mr. Auten.

♦

D. V. Sawhill has been elected president, Mercer Tube & Mfg. Co., Sharon, Pa. He succeeds Henry Greenberg.

♦

Thomas E. Millsop, president and director, Weirton Steel Co., Weirton, W. Va., has been elected to a vice presidency of National Steel Corp., Pittsburgh, parent company.

♦

Ralph Hering has been appointed district manager of sales, Superior Steel Corp., Pittsburgh, with offices in the Mutual Home building, Dayton, O.

♦

Frank W. Curtis, formerly manager, Firthite division of Firth-Sterling Steel Co., McKeesport, Pa., is now chief engineer, Van Norman Machine Tool Co., Springfield, Mass.

♦

Charles R. Hook, president, American Rolling Mill Co., Middletown, O., will be honored at a dinner planned by civic leaders April 18 at Manchester hotel, Middletown. Reservations will be limited to 1300.

♦

John C. Chaffe, a member of Republic Steel Corp.'s Philadelphia district sales staff, has been appointed assistant district sales manager at Philadelphia. Formerly he was vice president, Wrought Iron Co. of America, Lebanon, Pa.

♦

G. S. Martin, director of purchases, American Bantam Car Co., Butler, Pa., has resigned. Prior to joining that organization he was assistant purchasing agent for a number of years at Willys-Overland Co., Toledo, O. For the present he is located at Elyria, O.

C. I. Auten

♦

Harry B. Holland is now associated with Strong Steel Foundry Co., Buffalo, as sales representative in the eastern district, with headquarters at 860 Prospect street, Roselle Park, N. J.

♦

A. C. Hanson has been appointed district representative and sales engineer in the Detroit territory for Foote Bros. Gear & Machine Corp., Chicago, replacing Everett G. Akridge. Mr. Hanson formerly covered the northern Indiana and southern Michigan area.

♦

Harold S. Falk, vice president and general manager, Falk Corp., Milwaukee; Donald J. Campbell, president, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., and James R. Allan, assistant manager of industrial engineering and struction, International Har Co., Chicago, have been chos the board of awards, Am Foundrymen's association, Ch to receive gold medals, whic be presented at the association nual convention in Cincinnati, 15-18.

The John A. Penton gold m is being given to Mr. Falk in r nition of his leadership in pr ing interest in foundry appre training; the W. H. McFadden medal to Mr. Campbell as pres of Campbell, Wyant & Canno outstanding accomplishments o company in casting manufact processes; and the J. H. Wh gold medal to Mr. Allan in rec tion of his engineering contribu to the association and the fou industry.

♦

Wyman Howells, formerly as ated with the Reading Iron Philadelphia, has joined the H ton, Tex., office of Allegheny lum Steel Corp., Pittsburgh, salesman specializing in the sa Allegheny Ludlum lap weld pipe, effective April 15.

♦

David Dasso has resigned as president, American Locom Co., diesel engine division, York. He will be retained in a sulting capacity and also will tinue as United States repres tive of Sulzer Bros. Ltd., Wi thur, Switzerland.

♦

William Hume, formerly mana of sales, wire and wire prod division, Pittsburgh Steel Co., P burgh, has been named general m ager of sales. Other promotions the sales department are: J. Ker dy Beeson, heretofore assist manager of sales, is now assist general manager of sales; Henry Roemer Jr., Pittsburgh district sa manager, has become manager sales, rod and wire products d

Harold S. Falk

D. J. Campbell

James R. Allan

William M. Jensen, former district sales manager, has ade Pittsburgh district sales r, succeeding Mr. Roemer, on A. Mullen succeeds Mr. as Chicago district sales r. Mr. Mullen formerly was t district sales manager at ork.

♦

B. Kraft has been ap- manager, roll sales depart- ewis Foundry & Machine di- Blaw-Knox Co., Pittsburgh. aft has been with the divi- other capacities for some nd has had considerable ex- e with the steel industry as facturers' agent.

♦

. Bussmann, manager, wire epartment, Wickwire Spencer ., New York, has been trans- o Buffalo, where in addition

A. G. Bussmann

inuing as wire sales manager, direct all activities of that

aduate of Carnegie Institute hnology, he served as chem- the New York public service ssion and then for 14 years mist and welding engineer, an Steel & Wire Co., after he joined Wickwire Spencer e and springs sales manager. McSheehy, since 1931 Chi- istrict manager of Wickwire r, has been placed in charge firm's hardware products de- nt, in addition to his present The department has been from New York to the Mid- n office at 221 North LaSalle Chicago. Prior to joining the o sales office of Wickwire in Mr. McSheehy was identified e American Steel & Wire Co. nnsylvania railroad.

♦

M. Wilson, president, Na- Supply Co., Pittsburgh, has nade chairman of the board. Geismer, heretofore vice presi-

Ralph B. Kraft

dent and general manager, has been named president. A. E. Walker becomes vice president; C. A. Meyer, treasurer, and R. W. Eiler, secretary. Other vice presidents are: C. R. Barton, F. H. Green, and D. S. Falkner.

♦

Otto Kafka Jr. has been elected president, Otto Kafka Inc., New York, exporter and importer of iron and steel products. He succeeds the late Otto Kafka. Robert Kafka has been named vice president. Herman Gaffron continues as secretary-treasurer.

♦

Charles Thiede, chief tool engineer, Jefferson plant of Chrysler Corp., has been elected chairman, Detroit chapter, American Society of Tool Engineers. S. K. Kuhn, McCrosky Tool Co., has been made vice chairman; B. L. Diamond, Modern Tool Co., secretary; and Lawrence H. Howe, Lincoln Park Tool & Gage Co., treasurer.

♦

Charles Dorrance has been elected president, West Virginia Coal & Coke Corp., Cincinnati, succeeding Col. Robert W. Lea, who resigned to become vice president in charge of finance, Johns-Manville Corp., New York. Mr. Dorrance has resigned his position as vice president in charge of operations, Consolidation Coal Co. Inc., New York.

♦

J. S. Richards, manager, metallurgical department, American Steel & Wire Co., Cleveland, has announced appointment of the following five new members to the main office metallurgical staff: L. F. McGlincy, formerly open-hearth and hot mill superintendent at Worcester, Mass., now is division metallurgist on heating and hot rolling; R. H. Barnes, heretofore district metallurgist in Cleveland, is division metallurgist on flat rolled products and strip; A. F. Ilacqua, formerly standard practice metallurgist at Worcester, is assistant division metallurgist on high-carbon products; John F. Occasione is assistant division metallurgist on coatings, whereas formerly he was in charge of similar work for the Cleveland district; J. E. Millen, previously in charge of statistical work in the physical laboratory, Cleveland district, is assistant division metallurgist on standard practice.

DIED:

■ HUGH M. RICHARDS, 51, manager of strip and sheet sales, American Rolling Mill Co., Middletown, O., in Middletown April 6. Mr. Richards was associated with the company's sales department many years. From 1924 to 1931 he was sales manager in the Cleveland area; later was named assistant general manager of sales; in July, 1937, was appointed manager of strip and sheet sales.

♦

George F. Libby, 37, director of sales and advertising manager, Master Lock Co., Milwaukee, April 2 in that city. He joined the firm 15 years ago.

♦

William P. Carpenter, treasurer, Mullins Mfg. Corp., Salem, O., until his retirement in 1932, recently in that city. He had been with the firm 52 years, 41 of which he was treasurer.

♦

Walter H. Neubert, 62, the past 18 years chief tool supervisor, A. O. Smith Corp., Milwaukee, in that city, recently. He was one of the four original employes of the company when it started manufacturing bicycles many years ago.

♦

Bruce Hill, first vice president and sales manager, Hill & Griffith Co., Cincinnati, and well known in the foundry industry, in Cincinnati, April 5. Mr. Hill was active in the Cincinnati chapter, American Foundrymen's association and was chairman of the finance committee which was making arrangements for the forthcoming convention of the A.F.A. which will be held in that city in May.

♦

Thomas S. Grubbs, 66, vice president, Union Switch & Signal Co., Swissvale, Pa., April 2 in that city. He joined Westinghouse Machine Co. in 1888 and when the company was merged with Westinghouse Electric & Mfg. Co. in 1915 he became secretary and auditor. In that year he was elected secretary, Union Switch & Signal Co., subsequently becoming treasurer and vice president. Continuing in those positions he also was elected comptroller, Westinghouse Air Brake and subsidiaries in 1927.

"It's my job to save space ..keep down weight"

THE DESIGNER

"I've got to make it work!"

THE ENGINEER

"It's up to me to find the best source of supply"

THE P. A.

"I've got to use it . . . will it satisfy?"

THE CUSTOMER

When all four agree the result is not always the chea
part . . . nor the most expensive part . . . BUT TH
PART WHICH DOES BEST the things required o

BARNES-MADE SPRINGS are made with a syn
thetic ear to the customer's problem . . . and an eye to
assembling costs.

*You'll find BARNES-MADE PRODUCTS in chain-s
merchandise . . . in Production Lines of automobile ma
. . . refrigerator manufacturers . . . even in priceless labora
equipment.*

Knowing how GOOD to make it is just as importan
knowing HOW to make it.

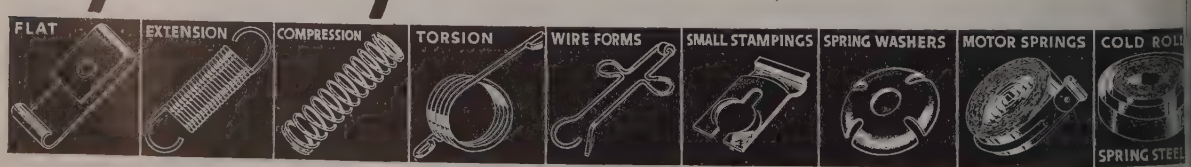
Next time and forever after "GET A BARNES QUOTATIO

Springs

The Wallace Barnes Compa

DIVISION OF ASSOCIATED SPRING CORPORATI

BRISTOL, CONNECTICU



SPRINGMAKERS FOR MORE THAN THREE QUARTERS OF A CENTU

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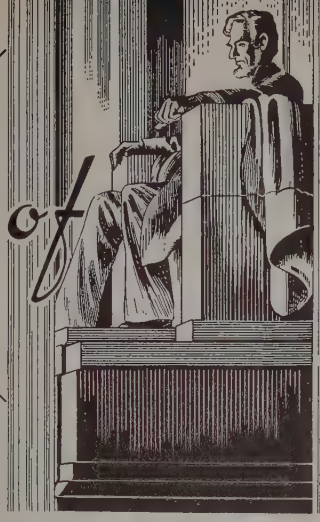
Windows of WASHINGTON



By L. M. LAMM
Washington Editor, STEEL

WASHINGTON

GUMENT on the appeal of eastern steel mills from a court decision refusing to permanent an injunction t minimum steel wage sched- under the Walsh-Healey act eard in District of Columbia of appeals last week.

Max Gardner and Frederick O. t represented the steel com- while Edward J. Ennis of the ment of justice and C. E. of the labor department rep- ed the government. Associate es Justin Miller, Henry W. ton and Fred M. Vinson heard se.

appellate court granted the industry a temporary injunc- gainst the secretary of labor, ng enforcement of minimum until it has decided the At the argument last week the ment asked dismissal of the tion or, failing that, that the companies be required to post Then if government finally the case the steel companies be required to pay the differ- n back wages. Court did not te when it would rule on this n.

n sides were given until April which to file further briefs. nsel for the steel companies sed location of the various , minimum wages paid and ive bargaining agreements.

ks "Locality" Interpretation

Knight argued the principal ds on which the determination ttacked. That dealt with the "locality" as used in the act and as referred to in the labor ary's decision.

charged the construction by bor department of the term plainly erroneous as matter v and that the determination ated thereon was, therefore, d the statutory authority of ecretary of labor."

Knight said the steel companies claim that "under the guise of construction of the term 'locality' the determination attempts to raise wages, by fixing minimum wages never theretofore existing in the several localities in which appellants' plants are situated, instead of ascertaining what in fact are the prevailing minimum wages, currently paid and actually prevailing in such localities, as required by the act.

"Such wage raising and fixing, it is claimed, was sought to be accomplished by including such localities in a large region also embracing Pittsburgh, Youngstown, and other localities to the west in which, because of various geographical advantages enjoyed by the plants situated therein, the prevailing minimum wages for iron and steelworkers are higher than those in the localities in which appellants' plants are situated and labeling such large region, consisting of 13 states, part of a fourteenth, and the District of Columbia, a 'locality' within the meaning of the act."

Questions Constitutionality

It was further contended by counsel for the steel interests that "locality," as employed in the act, means the city, county, village or other civil subdivision of a state in which work under a particular government contract is to be performed, or the immediate vicinity of that place, or, at most, a narrowly restricted geographical area.

Steel counsel also spoke of the injury which already has occurred to the appellants "due to the unlawful invasion of their rights" and what is actually threatened in the immediate future. It was further contended by counsel that the construction placed on the act by the secretary would, if sustained, raise "grave doubts as to the constitutionality of the statute."

Government counsel contended the steel companies have no standing to sue "because they have no legal right which will be injured or interfered with by the prevailing minimum wage determination of which they complain."

It was argued by government counsel the steel firms "have no legal right to do business with the United States government." It was contended since the companies have no legal right to do business with the government at all, "the asserted illegality of the minimum wage determination is irrelevant."

The government argued the steel companies have no legally protected right to be free from impairment of their competitive position to bid successfully for government contracts.

He argued that even if the companies "may be said to have a standing to sue" that the prevailing minimum wage determination of which they complain is not subject to judicial review.

Concluding government argument: "This court has no jurisdiction to review the prevailing minimum wage determination of the secretary of labor of which these appellants complain. This jurisdictional deficiency is not related to the position of these particular appellants, but goes to the power of the court to review the determination, as such, at all. Whether the determination may be reviewed in a different type of proceeding is another question, but consideration of this character cannot affect the conclusion as to the status of the complaint in the present proceeding."

The court has taken the case under advisement.

SENATE VOTES $600,000 FOR ECONOMIC COMMITTEE

Senate has passed a joint resolution providing an additional appropriation of $600,000 for expenses for the temporary national economic committee.

When this committee was created last year, an appropriation of $500,000 was allowed; that money al-

ready has been expended. The additional $600,000 which has just been appropriated by the senate and which will undoubtedly pass the house soon will provide for the activities of the committee until Jan. 1, when congress will make further appropriation if necessary.

Security and exchange commission has announced through the national economic committee that it has begun a nation-wide fact-finding study for the needs of small business for capital financing.

Object of the study is to obtain a concrete picture of the financing problem faced by small businesses. Facts sought include: (1) detailed estimates of the needs of small business for capital financing; (2) the various sources of capital and the various financial channels through which small businesses may obtain financing; (3) the factors which may operate to prevent small businesses from obtaining capital.

The commission's study, being conducted by the investment banking section of its monopoly study division, will include both a thorough analysis of the reports of private credit agencies and on-the-ground field surveys in selected areas and key cities.

URGES RESEARCH IN SMALL BUSINESSMAN'S PROBLEMS

Secretary of Commerce Hopkins last week sent a letter to Representative Lea, chairman, house interstate and foreign commerce committee, endorsing a bill to provide an appropriation of $2,000,000 for the commerce department for business research.

The bill provides the department furnish assistance to small business through research into their problems similar to the research facilities now available to large business enterprises.

Secretary Hopkins said he believed the program proposed "should be directed particularly to the vital needs of small business enterprises which was not done in the original bill." The bill, as introduced in the house by Representative Lea, simply made provision for business research within the department of commerce but did not specifically mention small business.

REDUCE DUTY ON GALVANIZED SHEETS IMPORTED BY TURKEY

In the trade agreement between the United States and Turkey, a 5 per cent reduction is provided on zinc-galvanized iron and steel sheets, up to a minimum of 3 millimeters, imported into Turkey.

Large quantities of American sheets have been imported in competition with the local industry under the pre-agreement rate of duty, the ad valorem equivalent of which was approximately 36 per cent. This item is one of the largest, in point of value, in Turkey's imports from the United States. In 1937, imports of galvanized sheets from the United States were valued at about $1,000,000 Turkish pounds ($880,000) and represented 91 per cent of the total Turkish imports of this item.

PATTERSON SILENT ON "BUSINESS APPEASEMENT"

While predicting good business for 1939, Richard C. Patterson Jr., assistant secretary of commerce, did not discuss business "appeasement" when he talked here last week to representatives of the electrical manufacturing industry. In fact, no administration spokesman has had much to say during the past couple of weeks about co-operation with the government—leading topic some weeks ago.

Mr. Patterson told the manufacturers there were many elements of strength in the present situation and called attention to the increased national income, improved profits, the absence of inventory liquidation and "burdensome stocks in distribution channels and increased employment."

An important factor in assuring further business expansion, he said, "is the maintenance of price policies on the part of business which will foster a further expansion in output, and not choke off, by short-sighted action, the demands which can only be met by a program which has high volume as its objective."

PROPOSE AMENDMENTS TO LABOR RELATIONS ACT

B. C. Heacock, president, Caterpillar Tractor Co., Peoria, Ill., and a special committee of business men representing the United States chamber of commerce in a report just made public urged substantial revision of the national labor relations act to eliminate unfair and discriminatory provisions.

"There has been ample demonstration that the law has had the effect of disrupting rather than of promoting amicable relations between workmen and those for whom they work," the report states. "It has promoted public disorder and disregard for personal property rights, in defiance of constitutional and statutory safeguards. It has injected the federal government as an active and as a biased participant into the field of labor disputes, not only as between employers and employes but also as between rival labor organizations.

The committee made a number of recommendations for amendments which it believes will correct some of the inequalities in the act. These amendments would include giving employers the right t
tion for certification of barg
agencies; to guarantee the ri
freedom of speech between e
ers and employes; to pro
coercion from any source; a
limit labor organization repre
tion to its own members in
tive bargaining negotiations.

Still other amendments pro
would repeal the closed sho
viso; restrict the labor rel
board to the determination of
transferring its judicial functi
the federal courts or some oth
propriate agency.

GOVERNMENT IRON, STEE AWARDS AGGREGATE $147,8

During the week ended Ap
the government purchased
835.73 worth of iron, steel and
products under the Walsh-H
act as follows: Keystone St
Wire Co., Peoria, Ill., $12,9
Crucible Steel Co. of America,
York, $26,427.50; Albert & I
son Pipe Corp., Brooklyn, N
$54,496.42; The Timken Roller
ing Co., Steel & Tube Division,
ton, O., $18,440; The Alum
Cooking Utensil Co., New Ken
ton, Pa., $12,170.97; Comme
Iron Works, Portland, Oreg.,
549; and Fassler Iron Works
New York, $12,785.

Tennessee Increasing Pre-Fabricated Capaci

■ Installation of machinery
quired for quantity productio
cold formed steel sections to be
in prefabricated building units
houses and other structures
been started in the Tennessee
Iron & Railroad Co.'s fabric
shop at Fairfield, Ala.

Equipment to be installed
cludes forming, welding, assemb
painting and drying machinery.
work will require approxima
five months. In addition to
equipment purchased, much of
machinery now in use at the f
cating shop will be modernized

Tennessee entered the pref
cated metal structures field sev
months ago, producing stan
panel sections with facilities
available in the fabricating s
Fourteen units of farm dwelli
and outbuildings were sold to
Farm Security administration
erection on rural sites in Alaba
Georgia, South Carolina, Florida

Recently an accumulation of
eign and domestic orders mad
necessary to quicken productio

"This company does not ex
to go into the erection or retail
of the structures," said Rob
Gregg, president. "It is our
tention to supply the prefabrica
material to contractors, builders
large-volume purchasers."

[ATION

ERIES ACCELERATED ON ,0,000 AIRCRAFT BACKLOG

ITARY aircraft builders are g up deliveries on current ll orders to clear production s for the large "rush" con- impending under army and air expansion programs. gs totaling $95,000,000 since have raised backlogs to more 200,000,000, a record high. A ago backlogs amounted to 0,000.

rvers predict the aircraft in- s total 1939 output will ap- ate $225,000,000, compared n estimated $170,000,000 last

ign buyers placed 85 per cent year's new business. It is l out warplanes and parts omprised 90 per cent of the 0,000 in armament licensed port since the neutrality act e effective in 1935. Best cus- : Great Britain, China, Neth- s East Indies and France.

lit negotiations for purchasing e engines costing $15,000,000 een completed by the Chinese alist government with Amer- ngine manufacturers, includ- nited Aircraft Corp.

al Dutch Airlines has just an order with the El Segundo n of Douglas Aircraft Co. Inc., El Segundo, Calif., for four 16-passenger DC-5 transport planes.

Navy contracts awarded last week: Brewster Aeronautical Corp., Long Island City, N. Y., planes and parts, $321,529; and Wright Aeronautical Corp., Paterson, N. J., engines, $248,057.

Brewster also booked an order from W. L. Maxson Corp. for two experimental radio-controlled planes designed for gunnery practice.

Harvill Aircraft Die Casting Corp. last week was organized in Los Angeles with capital of $500,000. Marcus L. Roberts, Los Angeles, is representative. Also newly-formed is Mercury Aircraft Inc., Los Angeles, capitalized at $75,000.

Seek To Finance Expansion

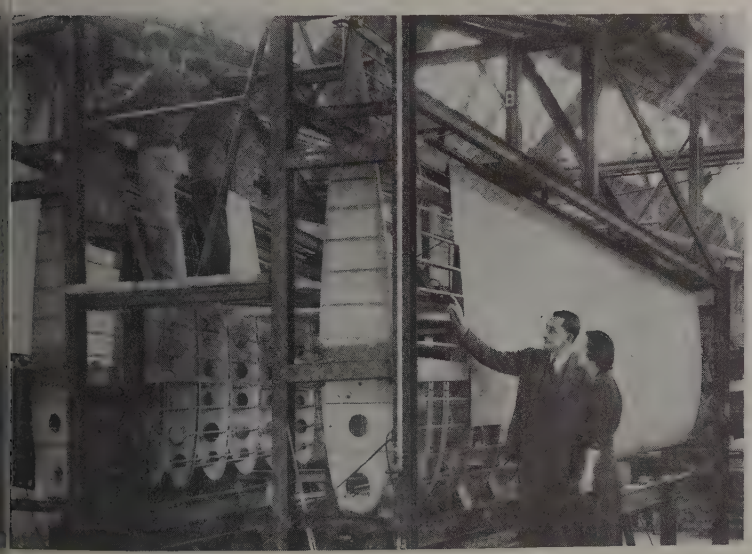
Aeronautical concerns recently announcing new security issues for expanding plant facilities and increasing working capital: Steel Products Engineering Co., Springfield, O., $840,000; United Aircraft Products Inc., Dayton, O., $567,000; Menasco Mfg. Co., Los Angeles, $400,000; Fairchild Engine & Airplane Corp., Hagerstown, Md., $86,200; and Seversky Aircraft Corp., Farmingdale, L. I.

Improvement in flying safety currently is reflected in substantial traffic gains by passenger carriers. National Safety council last week reported the past winter was best from standpoint of safety in the 12-year history of commercial air transportation. Only two major accidents occurred.

Plans for "urban airports" enabling airlines to bring their passengers into the center of metropolitan business districts are advanced by George and Andrew Farkas, British engineers now in the United States. Proposed flat-roofed, multi-storied structures in downtown areas would provide landing and storage space for rotary-wing aircraft of the autogyro and helicopter types which would operate shuttle service to the outlying air terminals.

New light-weight, 500-horsepower airplane engine which is said to be 200 pounds lighter than similar models has been developed by Ranger Engineering Corp., Farmingdale, L. I. Of the air-cooled, in-line type, it weighs 640 pounds, or 1.28 pounds per horsepower.

Fabricate Wing Panels in Steel Frame



ng panels of the new Vega airplane being fabricated in steel jigs at the ak, Calif., plant of Lockheed Aircraft's Vega division. The craft introduces ation a new type of power plant, the "Unitwin," comprising two Menasco s mounted side by side and driving a single propeller. If one engine stops, -wheeling device prevents it from dragging on the other, which continues in operation

Finds Great Deficiency In Capital Facilities

■ Reduced financial resources available to business since 1930 have created the greatest deficiency in capital facilities in our history, according to *Capital Goods and the American Enterprise System,* published last week by the Machinery and Allied Products institute, Chicago.

"The way to recovery and prosperity in America lies in supplying this deficiency," the book continues.

By the end of 1938 there was a deficiency of more than $61,500,000,000 in business savings; new security issues in recent years have averaged only 17.5 per cent of the annual volume in the 1920's, and use of bank credit has declined drastically.

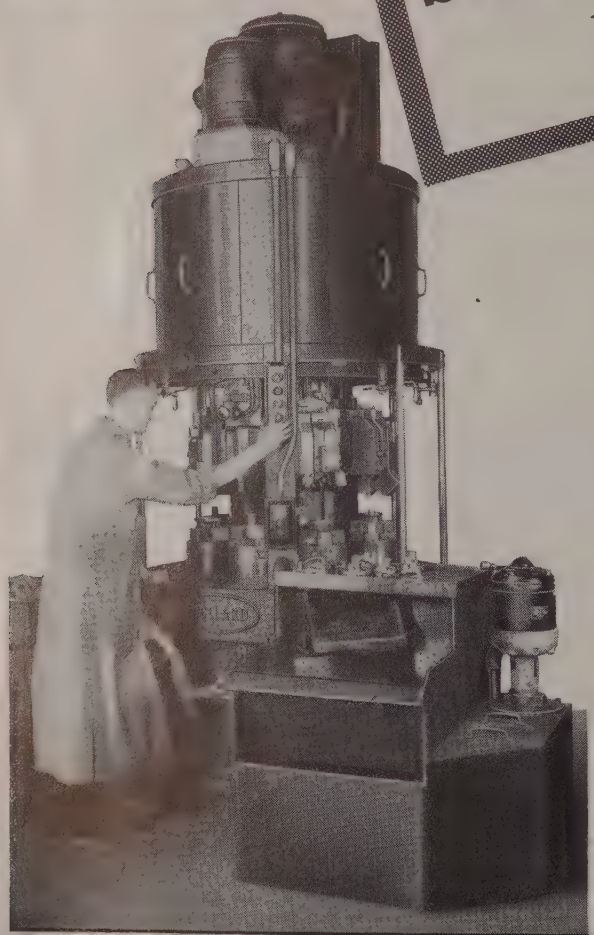
"There is overwhelming evidence that there has been serious stoppage of the flow of savings and credit into business enterprise. This is the outstanding phenomenon of this decade of depression."

Books Two Open Hearths For Dominion Steel

■ Arthur G. McKee & Co., Cleveland, have booked an order for two 100-ton open-hearth furnaces for Dominion Steel & Coal Corp. Ltd., Sydney, Nova Scotia. Construction will begin in about 30 days.

The corporation now has 12 open-hearth furnaces, including two 100-ton and ten 50-ton units, with total annual capacity of 400,000 gross tons. The new open hearths will increase this to 540,000 tons. It also has one electric furnace with annual capacity of 25,000 tons.

SATISFIED USERS *tell the story*



J-7 MULT-AU-MATIC

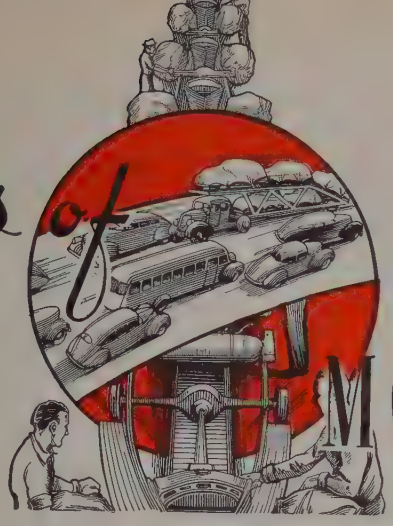
Here's a case where the Type "J-7" Mult-Au-Matic was tooled for several comparatively short run jobs. It proved so Profitable on the original set-up that it was considered unprofitable not to find other jobs to be done the Mult-Au-Matic way. Today there are eleven different jobs being done on this machine and more to come.

Said one man: "If we can make money this way, I can't see why others don't jump at the chance, too."

We'll help. Send in your Problem jobs, because as a rule Problem jobs are no Problem at all when set-up on the Mult-Au-Matic.

THE BULLARD COMPAN
BRIDGEPORT, CONNECTICU

Mirrors of MOTORDOM



By A. H. ALLEN
Detroit Editor, STEEL

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DETROIT

THIN the next two weeks as-
es should be started on the
y midget car, first mentioned
se columns May 9, 1938.

he past year this project has
hot and blown cold a num-
times, as late as last Septem-
ing to all appearances dead.
y after the first of this year,
er, it was reopened, although
bout six weeks even those
to the Crosley organization
any rebirth of activity. Look-
ack on this four-month sus-
n of activity, some observers
nto it a reshuffling of person-
Mr. Crosley himself.

y assemblies at the Rich-
Ind., plant of Crosley likely
e confined to a few hundred
with production getting into
wing around May 1. It will
alled the car is to be a single-
ype accommodating three pas-
s, built on rather short wheel-
nd a narrower than conven-
tread. Power unit is a 2-
er engine being built by Wau-
Engine Co. Bodies and frames
ing supplied by Murray here.
Mfg. Corp. in Toledo, O., is
g axles, and within the last
weeks contract for wheels is
ed to have been placed with
Wheel Corp. at Lansing.

rally a number of other sup-
figure in the business, and
are some parts, seat cushions
ample, still to be placed. But,
d large, arrangements have
oncluded for the bulk of the
tion needs.

elty, price and economy nat-
will be the three major talk-
oints in connection with sale
Crosley venture into the au-
ve field, which marks the
nation of a 20-year hobby on
rt of Mr. Crosley and com-
nts his interests in the radio receiving and broadcasting, refrigerator, baseball, hairgrowing machine and other lines. Originally, it is related, a price of $299.50 was determined for the new car, but later cost analyses may show it necessary to increase this somewhat to between $300 and $400 which would still put the product below any other car in price.

With a small 2-cylinder engine, economy of 50 miles per gallon does not appear improbable. And there is no disputing the novelty incident to introduction of such a vehicle to the American automobile trade. These three factors may combine to make a success of the venture in a market which other car manufacturers do not cultivate except insofar as used cars are concerned.

One authority reasons that if Crosley does not go beyond, say 75,000 assemblies per year, he may be able to avoid serious competition with other manufacturers and at the same time realize a fair profit for his company, by the same token providing employment to several thousand and developing a new market for materials and equipment necessary to manufacture of the car.

On the other hand, experienced persons in the automotive and allied industries in this territory are practically unanimous in refusing to concede the possibility of success to the Crosley venture. They reason the automobile buying public in this country will purchase an inexpensive used car in preference to a new car below standard in size and power. Whether this viewpoint is correct or not will be proved in the

Layout Board Aids Planning

■ When the question of relocating present plant equipment or installing additional machines comes up, this three-dimensional master layout board of the Plymouth plant in Detroit is of valuable assistance. Here D. S. Eddins, Plymouth president (center), and P. C. Sauerbrey, production vice president (left), consult with plant engineer C. C. Williams on some proposed changes in connection with 1940 models

next year or two. Certainly the appearance of a new name on the automobile horizon is a welcome sign, one which should be hailed for its healthy effect on the rest of the industry.

■ SUPPLEMENTING recent comment in this department with regard to Hupmobile, S. L. Davis, president, in an interview with the writer, states there has been "absolutely no friction with any of the corporation's suppliers," that plans for introduction of the Skylark models are proceeding on schedule, that the first bodies for a lot of 30 cars were received last week from Hayes at Grand Rapids, that assembly of an initial run of another 700 cars will follow directly.

Regular line production of Skylarks, on the basis of 2000 per month, will be initiated as soon as tooling is completed. The first 730 jobs are being assembled partly from materials received in inventory at the time of the purchase of property of the Cord Corp. From the windshield forward, the Skylark has been redesigned from the former Cord style, but the balance of the car is practically identical. Mr. Davis reports 6000 orders for Skylarks are now in the hands of dealers and every effort is being made to speed production to fill these orders.

Senior Models Lower

Incidentally, the senior Hupp lines for 1940 will show a more definite resemblance to the Skylark models, and both sixes and eights will be lowered about 3½ inches in overall height, as well as appreciably in price. The 1939 run on senior models is being concluded this month.

Recently, Mr. Davis addressed a group of dealers here and drew a rather interesting picture of the car of tomorrow. Quoting:

"We see an engineering revolution in the motor industry. We see the horse-and-buggy type of construction, which has existed for more than 40 years, suddenly changed by a new and better order of things. This change should be brought about by an independent manufacturer. The new order of cars will be made practically without dies. Die costs now are the greatest and most serious problem facing the independent.

"This revolutionary new car will be attractive, roomy, comfortable, safe, economical, low priced. We see an entirely new type of body construction, starting first with a molded top of a tempered insulating material with the strength of steel and with insulating qualities that have never been approached or seriously considered in the construction of passenger cars which are still too hot in summer and too cold in winter."

Hupp's Fostoria, O., division, by the way, is reported to be preparing to manufacture aircraft parts.

Automobile companies all are keeping a weather eye posted on aircraft developments. General Motors, for example, has readied a $5,000,000 improvement program for its Allison engine division at Indianapolis, reported to be awaiting government approval of the new liquid-cooled engine developed for high-speed pursuit ships. News came out of Washington last week that the war department shortly would authorize the purchase of 550 engines for use in these 400-mile-per-hour army planes.

A further well-authenticated report is that discussions have been initiated leading to a joint effort on the part of General Motors, Du Pont and the Budd interests in the mass production of airplanes of "shotwelded" stainless steel and plastics—Budd supplying the stainless steel welding technique, Du Pont the plastics and GM the mass production technique plus its knowledge of diesel engine building.

The plastics industry continues to make important strides, both in automotive and aircraft fields. One of the latest achievements is an aircraft wing section of molded plastic which meets demands of weathering and strength. Firestone Steel Products Co. in its plant here is now making steel instrument panels of cold-rolled strip and then ing over them a layer of p material.

Last week, at Franklin instit Philadelphia a demonstration witnessed by officials of five panies sponsoring the develo of a new type of combination and plastic—the latter a poly acetal resin—which would app have important possibilities fo mobiles. Six years of researc volving an outlay of $6,000,000. required for perfection of the rial which is said to be abou times more bendable than ord safety glass. It may even be up like a rug without the glas ticles leaving the plastic. Du Libbey-Owens-Ford, Pittsburgh Glass, Monsanto Chemical an Carbide & Carbon Chemicals participated in the joint rese

■ BABY depression which ha veloped with the past four w shows no very definite signs o up and the next few weeks sh tell the story as to whether it be prolonged throughout the mer or give way to the nc spring improvement. A dis tion is noted on the part of companies to spread releases parts required on the balance of runs over considerably longe riods, indicating perhaps a tap in assemblies this month and For example, one consignme parts originally required to s four weeks' production in April revised, without changing quant to cover five weeks, then six w and finally held up entirely.

Meanwhile, 1940 programs slow to mature, tool and die ests stating that a large volu work is anticipated but, with exceptions, has yet to be rele Other than a small amount o Soto work, little has appeared Chrysler, while Buick and stedt are about the only GM sions which have released a ciably. As time wears on, it ap the reported decision to spee new models so they could be ited at the coast fairs in Jul August was somewhat prema and from present indications it be late summer before a ge representation of 1940 creations be displayed. This would ind a rather protracted changeove riod this summer, since alrea disposition is noted to bring duction of current models to an close.

Addition to the Willys-Over line of a new series of cars t known as the Speedway specia been announced. The models clude deluxe equipment and s standard car price.

Automobile Production

Passenger Cars and Trucks—United States and Canada

By Department of Commerce

	1937	1938	1939
Jan.	399,186	227,130	353,946
Feb.	383,900	202,589	312,141
March	519,022	238,598	.....
April	553,231	238,133	.....
May	540,377	210,183	.....
June	521,153	189,399	.....
July	456,909	150,444	.....
Aug.	405,072	96,936	.....
Sept.	175,630	89,623	.....
Oct.	337,979	215,296	.....
Nov.	376,629	390,350	.....
Dec.	347,349	407,016	.....
Year	5,016,437	2,655,777	.....

Estimated by *Ward's Reports*

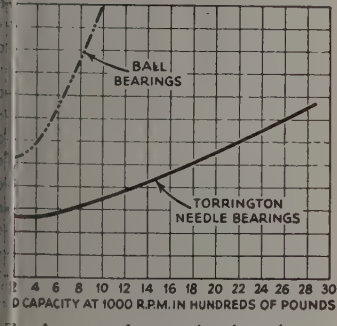
Week ended:	1939	1938†
March 11	84,095	57,438
March 18	86,725	57,555
March 25	89,400	56,800
April 1	85,980	57,500
April 8	87,019	60,975

†Comparable week.

	Week Ended April 8	Week Ended April 1
General Motors	32,735	33,260
Chrysler	20,525	20,375
Ford	22,230	22,230
All others	11,529	10,115

SEE HOW LITTLE the TORRINGTON Needle Bearing Costs You

ote in the accompanying graph the low cost of the Torrington e Bearing, compared with ball gs designed to carry the same ra- ad. See how little it will probably ou to use this new bearing—and to e advantages of anti-friction con- ion in your products.



its low purchase price is only one economies you can effect by using Torrington Needle Bearing. The ng is made in a single compact unit, at you can install it with a mini- of assembly time and expense. It can be quickly pressed into place on an ordinary arbor press—a method ideally adapted to the requirements of production line assembly.

You can often make other savings in the design of surrounding members. The shape of the bearing—its small diameter and long axis—allows you to use an extremely simple form of housing, with a consequent reduction in the amount of material needed.

High Load Capacity

The Needle Bearing has unusually high radial load capacity in proportion to its size, because its full complement of small diameter rollers provides many linear inches of bearing contact. It is suitable for severe service in either rotating or oscillating applications, and gives excellent results when used in high speed operation.

Lubrication of the Needle Bearing is efficient and thorough. The hardened retaining shell that forms the outer bearing race is provided with turned-in lips that hold plenty of grease or oil for long periods of operation. As the needles rotate, they constantly supply lubricant to the rotating shaft, insuring satisfactory lubrication with a minimum of maintenance attention.

Investigate the advantages of this low-cost anti-friction bearing in your own products. The Torrington Engineering Department will cooperate with you in laying out suitable applications for the Needle Bearing.

For further information, write for Catalog No. 10. For Needle Bearings to be used in heavier service, request Booklet No. 103X from our associate, Bantam Bearings Corporation, South Bend, Ind.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

Makers of Ball and Needle Bearings

Branch Offices in all Principal Cities

TORRINGTON NEEDLE BEARING

U. S. Steel "Reasonably Hopeful"; Finds Taxes Increasing Burden

■ "WE ARE reasonably hopeful concerning the immediate outlook for the steel industry," Edward R. Stettinius, board chairman, told United States Steel Corp. stockholders at their annual meeting in Hoboken, N. J., April 3.

Mr. Stettinius pointed out, however, that to forecast the future course of business "in these times is venturesome, to say the least."

Production for the first quarter this year averaged around 52 per cent, substantially better than the 1938 average. The board chairman noted a revival in demand for the heavier steel products, which, he said, should draw more evenly on finishing capacities and materially benefit operations of subsidiary companies.

Taxes, said Mr. Stettinius, loom more formidable than ever as a cost factor, particularly in a year of reduced tonnage volume. From this heavy charge he could foresee no relief.

Taxes $5.61 Per Share

Last year the corporation's total tax bill amounted to $48,842,131, equal to $5.61 per common share.

Taxes in 1938, he continued, other than federal income tax based on earnings, were $45,912,131, an increase of 22 per cent over 1929 and 30 per cent over 1926. Of total 1938 taxes, $11,309,215, or $1.30 per share of common stock, represented taxes paid in connection with social security legislation.

"This becomes increasingly significant when we realize that social security taxes are on a progressive scale, and do not reach their maximum until 1949.

"Thus, assuming that our payrolls in that year were in the same aggregate amount as in 1938, and the social security taxes we were required to pay in 1949 were at the rate now contemplated by the social security act, our taxes in that year for social security alone would amount to $16,000,000, and for a year of normally good operations, to as much as $26,000,000."

Important shrinkage in volume last year, combined with lower prices during part of the year, explained the corporation's reduction in sales, profits and employment, Mr. Stettinius said.

Attendance exceeded 250, second only to last year's record turn-out, when changes in the corporation's capital structure were voted. Proxies represented 2,198,089 shares of preferred stock, or 61 per cent, and 4,877,889 common shares, or 56 per cent. Total representation was 7,075,987 shares, or 57.5 per cent.

Robert C. Stanley, chairman and president, International Nickel Co., New York, was elected a director, to succeed Walter S. Gifford, president, American Telephone & Telegraph Co.

At the directors' meeting the following day Mr. Stanley was elected a member of the finance committee, succeeding Mr. Gifford. William A. Irvin, in accordance with his request last year, and after 44 years of distinguished service, retired as vice chairman of the board, which position was abolished. He will continue as director and member of the finance committee. All other officers were re-elected.

A feature this year was the presentation of a sound motion picture of the planning, construction and operation of the corporation's new Irvin works. This showing was held while the ballots were being counted.

Time of the meeting this year was advanced to 10:30 o'clock, instead of about noon as heretofore. This, it was believed, would be more convenient for stockholders. The usual lunch was served after the meeting had adjourned.

A new type of ballot was used, on which were printed the names of 35 independent auditing firms, with the name of another written in by a holder of ten shares of stock. Price, Waterhouse & Co., New York, received the votes of 7,109,802 shares, with the runner-up receiving votes of about 1700 shares.

Will Continue Pension System

In reply to a stockholder the chairman stated the corporation planned to continue its pension system, in conjunction with the social security act, but added it was impossible to say yet just how the two systems ultimately would be combined. The corporation is giving close study to the problem, he added. In reply to another stockholder, he said Myron C. Taylor is not receiving pension from the corporation.

Describing stockholders as "forgotten men and women," J. Newcomb Blackman, a stockholder and vice president of the American Federation of Investors, suggested "collective bargaining for stockholders, as well as steelworkers." He warned that unless stockholders' in... were better taken care of ... would eventually be no capit... investment and no jobs for a...

He suggested the sentime... stockholders should be recor... annual meetings on various ty... legislation affecting business... management.

Following recent changes i... corporation's capital structure... board of directors, Mr. Stet... said, authorized the applicati... $260,368,000 out of the capita... plus to reduce the item of in... ble assets to the present no... sum of $1, leaving a balan... $38,462,801 in the capital su... account.

"It is, of course, not possible... stated, "to evaluate convinc... what real value the intangible a... possess, but whatever the valu... be it is still in existence and i... affected in any manner by the ... reduction mentioned."

The net working assets incr... last year from $366,000,000 to ... 000,000. The cash and marke... security assets increased from ... 000,000 to $138,000,000.

Predicts Continuance Machine Tool Gains

■ "Machine tool builders look... a slow strengthening of the ... general upturn that began last ... mer," said August H. Tuec... president, Cincinnati Bickford ... Co., speaking last week before ... Cincinnati Credit association.

Sharp advances in machine ... sales since last summer have ... due in part to foreign business... of late there has been an encou... ing improvement in domestic or... he said. These have increase... foreign orders have declined.

Mr. Tuechter estimated 25 ... cent of all workers gainfully ... ployed in industry today owe t... jobs to industries, dependent on ... chine tools, which did not exi... 1900 or which were just gettin... to production at that time. ... machine tool industry, he said, ... ploys 50,000 workers. As a r... of their production—only a par... which is devoted to automotiv... 500,000 workers are directly ... ployed in automotive plants an... 000,000 derive their livelihood f... direct and affiliated automotive ... dustries.

■ Sixty-nine employes whose s... ice with the Tennessee Coal, Iro... Railroad Co. totaled 1935 years ... ceived United States Steel C... service medals during the f... quarter of 1939. Their service ... erage for the period was 2... years.

The Railroad Problem

■ RAILROAD travelers of late have been handed copies of a little booklet. It has a pale blue cover, with a picture of a carpenter's square, and the title "For Better Times—A Square Deal in Transportation." Prepared by the Association of American Railroads, Washington, it is intended to enable passengers to while away some of the time on long trips while at the same time becoming informed as to the basic causes of the railroad problem.

"Out of every dollar railroads take in, taxes take more than 9 cents, and the annual cost of providing and maintaining the roadway takes 23½ cents more.

"Out of every dollar taken in by the certified motor carriers who report to the interstate commerce commission, 4½ cents goes for taxes of all sorts, including license fees and gasoline taxes—and nothing more for roadway, which is built and maintained by the public.

Unequal Treatment of Carriers Is Root of Railroad Troubles

"Out of every dollar taken in by inland water carriers reporting to the interstate commerce commission, 2 cents goes for taxes—and nothing more for channels, which are built and maintained by the public.

"And the Federal Barge Lines, government-operated competitor of the railroads, pays nothing for taxes and nothing for its channels."

This unequal treatment, says the booklet, is the root of the railroad problem in this country. It goes on to outline measures that would remedy the situation and enable the railroads to get back on their feet.

Contrary to widely held opinion, the railroads are not overcapitalized, says the booklet. In 1910, when railroads as a whole were reasonably prosperous, their total capitalization amounted to $987 for each $1000 invested in railroad property. In 1937, with railroads in distress, total capitalization was only $715 for each $1000 of investment. That part of the total capitalization representing debt amounted, in 1910, to $606 for each $1000 of investment. In 1937 it amounted to only $439 for each $1000 of investment.

Neither, says the booklet, are railroad difficulties due to an increasing burden of fixed charges; that is, interest on debts and rentals for leased property. In 1937 these charges took 15.4 cents out of each dollar of railroad revenue, less than in any of the years prior to the World war, when the railroads were most prosperous.

Industry Has Stake in Aiding Better Understanding of Rail Needs

If enough educational work is done the railroad problem eventually may be solved. This is an effort which well may be shared by industry in general. It is estimated (see STEEL, March 20, page 34) that deferred maintenance on American railroads has mounted to $283,000,000 and that, in addition, these interests should spend $495,000,000 over the next three years—and these figures may be regarded as representing minimum normal requirements. Full participation of the railroads in our going volume of business is important for a return to prosperity.

There is another reason for pushing the educational work that is necessary for solution of the railroad problem. The extent to which the public and our legislative representatives are made to understand what makes the railroads go will make them understand what makes business in general go. A general realization along these lines will lead to increasing ability on the part of business to contribute to the country's welfare.

Steel Industry's Earnings Insufficie

To Pay Funded Debt Interest in 1938

■ TWENTY-TWO leading steel companies, representing 92.5 per cent of total ingot capacity, in 1938 incurred a $10,936,841 net deficit, after all charges but before dividends, STEEL'S thirteenth annual financial survey shows. For 1937, the same producers had $211,479,861 net profit.

Total income, before deducting bond interest, was $22,061,470, compared with $241,938,183 in 1937. Last year's total income, insufficient to meet funded debt interest, indicates 0.57 per cent return on total capitalization. This was the lowest since 1934. In 1937, the 22 companies earned 6.07 per cent on total capitalization. Highest return in recent years was in 1929 when 9.88 per cent on capitalization was reported. Most severe loss was in 1932 at 2.85 per cent on capitalization.

1938 Tax Bill More Than Four Times Total Earnings on Capitalization

Taxes paid by 21 of the 22 companies totaled $94,514,280 in 1938, against $159,992,152 in 1937 for the identical 21. Last year's taxes amounted to more than four times the companies' aggregate earnings on total capitalization, and were approximately twice the preferred stock requirements.

Total capitalization was $3,848,059,550 in 1938, compared with $3,984,383,189 in 1937, a reduction of $136,323,639. Aggregate surplus for all the companies was reduced $91,159,935, although eight of the companies made additions to surplus accounts. Funded indebtedness increased $164,580,306, from $681,069,821 to $845,650,127.

Number of common shares outstanding increased from 33,477,252 to 34,171,336; their valuation decreased from $1,781,998,030 to $1,569,756,693. Preferred shares valuation increased from $729,310,910 to $731,812,237.

For 18 companies reporting, operations averaged 39.3 per cent of ingot capacity in 1938, compared with 71.5 per cent in 1937. Net sales of 19 companies totaled $1,015,773,603, a 39.2 per cent decrease from the 1937 figure of $1,670,958,840. The leading producer, however, did not report net sales.

Midvale Co. showed the highest total earnings on capitalization with 10.06 per cent. Followed Keystone Steel & Wire Co. with 8.23 per cent, I Steel Co. with 5.30 per cent, Continental Steel with 5.15 per cent, National Steel Corp. wit per cent, and Inland Steel Co. with 4.73.

Net loss per ton of ingot capacity averaged 17 last year, contrasted with a 1937 net profit of Midvale earned $4.64 per ton of capacity; Ke Steel & Wire, $2.91; Rustless Iron & Steel $2.27; Inland, $2.10. National Steel actually e $2.32 per ton of capacity on average capacit the year, instead of the $1.96 listed in the accom ing table which is based on year-end capacity.

Net loss per ton of ingots produced averag cents for 18 companies reporting; in 1937, the companies earned $4.38 per ton of ingots produc

Losses per common share, after allowing for ferred dividend requirements averaged $1.73, trasted with average earnings of $4.92 in 1937

Of the 17 largest producers, only two showed ings on common stock, National and Inland $3.03 and $3.11 respectively. Midvale Co. e $6.22 per common share.

Total Assets Slightly Lower; Current Liabilities Reduced

Total assets for the 22 producers were $4,205,617, compared with $4,420,105,857 in 1937. Cur assets were $1,232,763,683 compared with $1,207,7 633. Current liabilities were reduced from $293,1 590 to $208,357,665.

Opposite this page is an insert giving deta comparisons for the 22 companies for 1938 1937. Extra copies will be sent to subscribers request them.

Several changes have been made in the list companies this year. Allegheny Steel Co. and Ludl Steel Co. merged in August, 1938, and are listed Allegheny Ludlum Steel Corp.; for the 1937 c parisons, the figures of Allegheny Steel Co. only used. Colorado Fuel & Iron Co. and Keystone S & Wire Co. have been added to the list. Vanadi Alloys Steel Co. has been dropped.

STEEL hereby acknowledges with sincere thanks t co-operation of the company executives for supp ing these detailed data.

The BUSINESS TREND

tivity Index Drifts
Lower Levels

FLECTING the minor variations in industrial ac- throughout the first quarter, STEEL's weekly index ged 91.1 in January, eased slightly to 90.8 in ary and advanced to 92.6 during March. The peak monthly average last year, 95.9, was recorded dur- ovember.

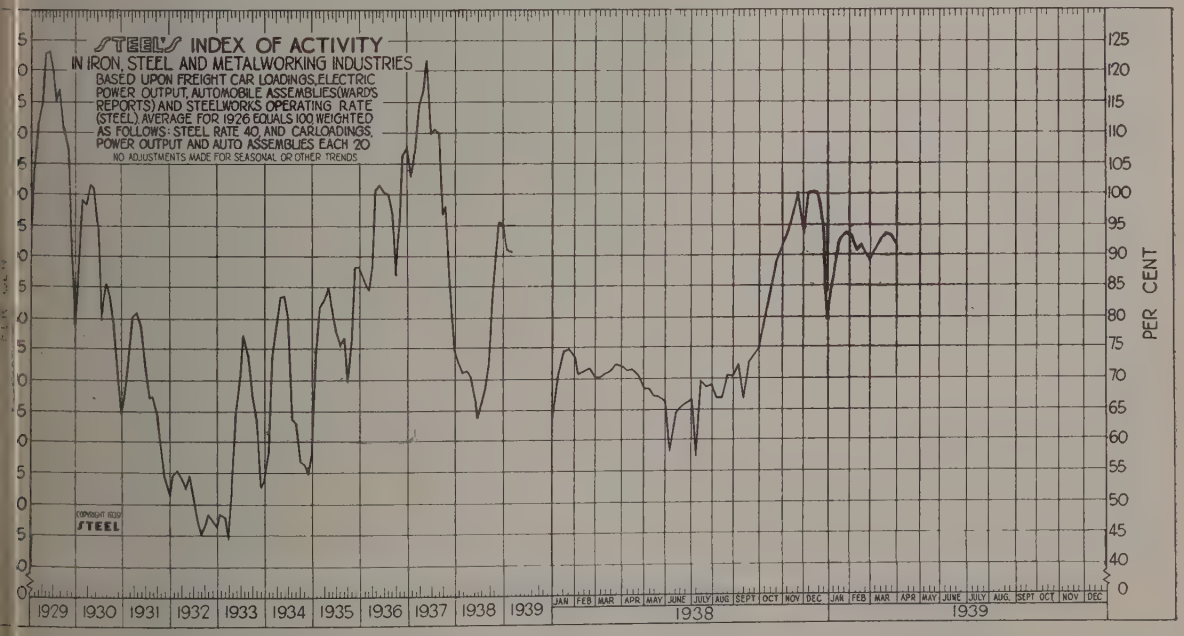
index average of 91.5 for the first quarter was sub- ally above the 71.9 average in the initial quarter ear, and compares with the average of 94.9 for nal three months of 1938.

ustrial activity in the iron steel and metalwork- ing industries, as registered by STEEL's index, declined in the week ended April 1 to 92.2, off 1 point from the preceding week. In the same week last year the index was 72.

Normally at this time a seasonal rise in the industrial indicators may be expected. Despite failure of industrial activity to expand in recent weeks, underlying forces of recovery seem well supported and no marked decline is expected.

Typifying the general hesitancy of industrial activity, steelmaking operations dropped in the week ended April 1 to 54.5 per cent. This is 2 points below the peak this year, registered in the weeks ended March 11 and 18. At this time last year the national steel rate, at 36 per cent, had reached the high point in the spring upturn.

Decision of automotive interests to even up field


STEEL'S INDEX OF ACTIVITY
IN IRON, STEEL AND METALWORKING INDUSTRIES
BASED UPON FREIGHT CAR LOADINGS, ELECTRIC POWER OUTPUT, AUTOMOBILE ASSEMBLIES (WARDS REPORTS) AND STEELWORKS OPERATING RATE (STEEL) AVERAGE FOR 1926 EQUALS 100 WEIGHTED AS FOLLOWS: STEEL RATE 40, AND CARLOADINGS, POWER OUTPUT AND AUTO ASSEMBLIES EACH 20
NO ADJUSTMENTS MADE FOR SEASONAL OR OTHER TRENDS
COPYRIGHT 1939 STEEL
PER CENT
1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939
1938
1939

STEEL'S index of activity declined 1 point to 92.2 per cent in the week ended April 1:

k ending	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929
7.....	86.5	70.1	107.8	90.2	65.4	53.6	45.3	55.8	69.2	88.1	94.8
4.....	91.9	74.4	106.7	89.3	73.8	58.1	48.6	56.2	72.1	91.8	104.2
1.....	93.0	74.7	104.0	86.0	78.1	60.9	49.8	55.8	72.9	96.3	107.5
8.....	92.9	73.8	99.6	86.5	79.5	62.3	50.8	56.2	72.9	97.4	109.8
4.....	90.7	70.9	100.8	83.8	81.8	66.9	49.9	56.0	74.9	100.8	111.3
1.....	92.1	71.2	101.9	85.9	82.7	70.7	48.7	55.5	75.4	100.9	111.7
8.....	91.1	71.9	108.8	81.8	82.8	72.4	48.3	54.5	76.0	97.7	112.6
5.....	89.3	70.3	112.8	83.4	80.5	75.5	46.0	55.1	75.8	99.7	109.2
4.....	91.5	70.1	117.9	87.7	81.1	76.8	47.4	54.1	79.2	98.3	113.5
1.....	92.7	70.8	112.7	89.7	82.0	78.6	43.4	54.8	80.6	97.5	114.8
8.....	93.3	71.3	113.1	86.0	84.0	79.9	42.7	54.4	81.3	98.1	115.0
5.....	93.2	72.4	114.0	91.2	84.0	79.7	44.6	53.5	80.6	99.6	115.0
1.....	92.2	72.0	112.0	96.8	84.3	79.3	45.2	53.4	81.5	97.6	115.9

stocks and await the immediate sales developments resulted in a temporary decline in automotive assemblies during the week ended April 1. Output slackened to 85,980 units, from 89,400 in the preceding week. In the comparable week last year 57,500 units were produced. Early estimate for March indicates motorcar sales aggregated 305,000 units against 196,000 in February. This is somewhat below the normal seasonal rise. Automobile production during March is estimated at 382,000 units, compared with 312,141 in February, and 238,598 in March last year.

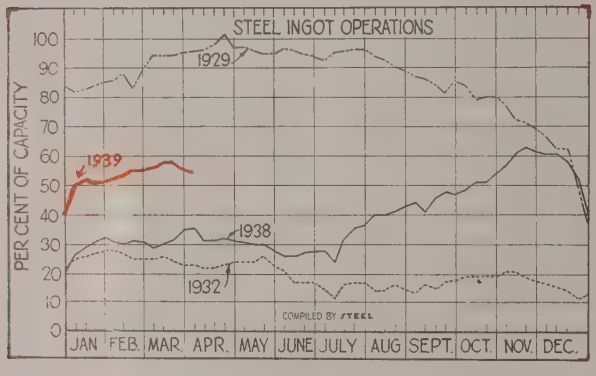
EXPORT BALANCE INCREASES SHARPLY

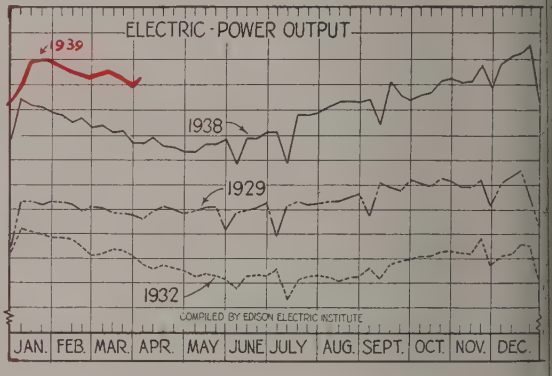
Reflecting trends in imports and exports during February, the export balance of trade rose to $60,524,000, from $34,708,000 in January. However, a year ago the export balance was much higher, at $98,984,000. Exports increased contra-seasonally during February, but this is offset somewhat by the abnormal decline registered in January from the December level. Imports declined sharply in February, whereas the seasonal expectation is for a slight decrease in the month. As a result February imports were at the lowest level since July, 1938. Exports in February amounted to $218,559,000, against $212,909,000 in January and $261,935,000 in February, 1938. February imports of $158,035,000 compared $178,201,000 in January and $162,951,000 in Februa year.

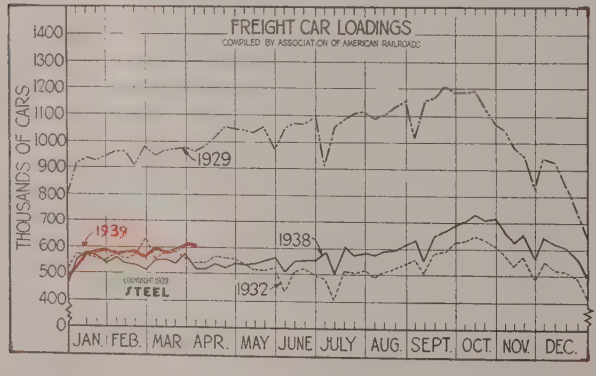
Following the general trend, exports and i of steel and iron products in February receded the January volume. Excluding scrap, February e totaled 134,777 gross tons with a valuation of $9,7 This represents a decline of 11 tons in volum $441,840 in value from January. Scrap exports February were also lower 224,913, compared with 884 in January, and 356,790 tons in February, 193 ports in February, excluding scrap, declined 27 pe in volume from the January total to 17,736 gros valued at $1,236,673. Scrap imports during Feb were lower at 1413 tons, compared with 3333 t January.

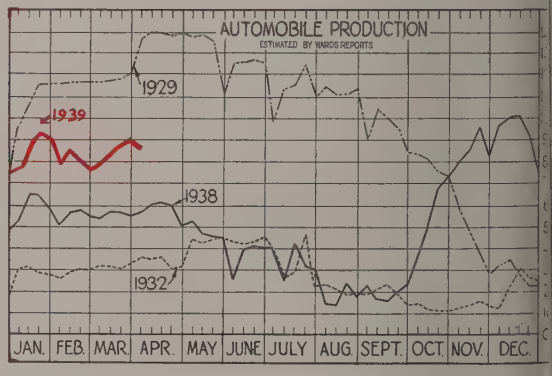
MARCH IRON OUTPUT UP 4.9 PER CENT

Average daily coke pig iron production in the U States during March amounted to 77,182 gross t substantial gain over the February rate of 73,578 The daily rate during February was the highest October, 1937, with 93,259 tons. In March last daily output averaged 47,426 tons. Active stacks on 31 numbered 123, compared with 121 on Februa

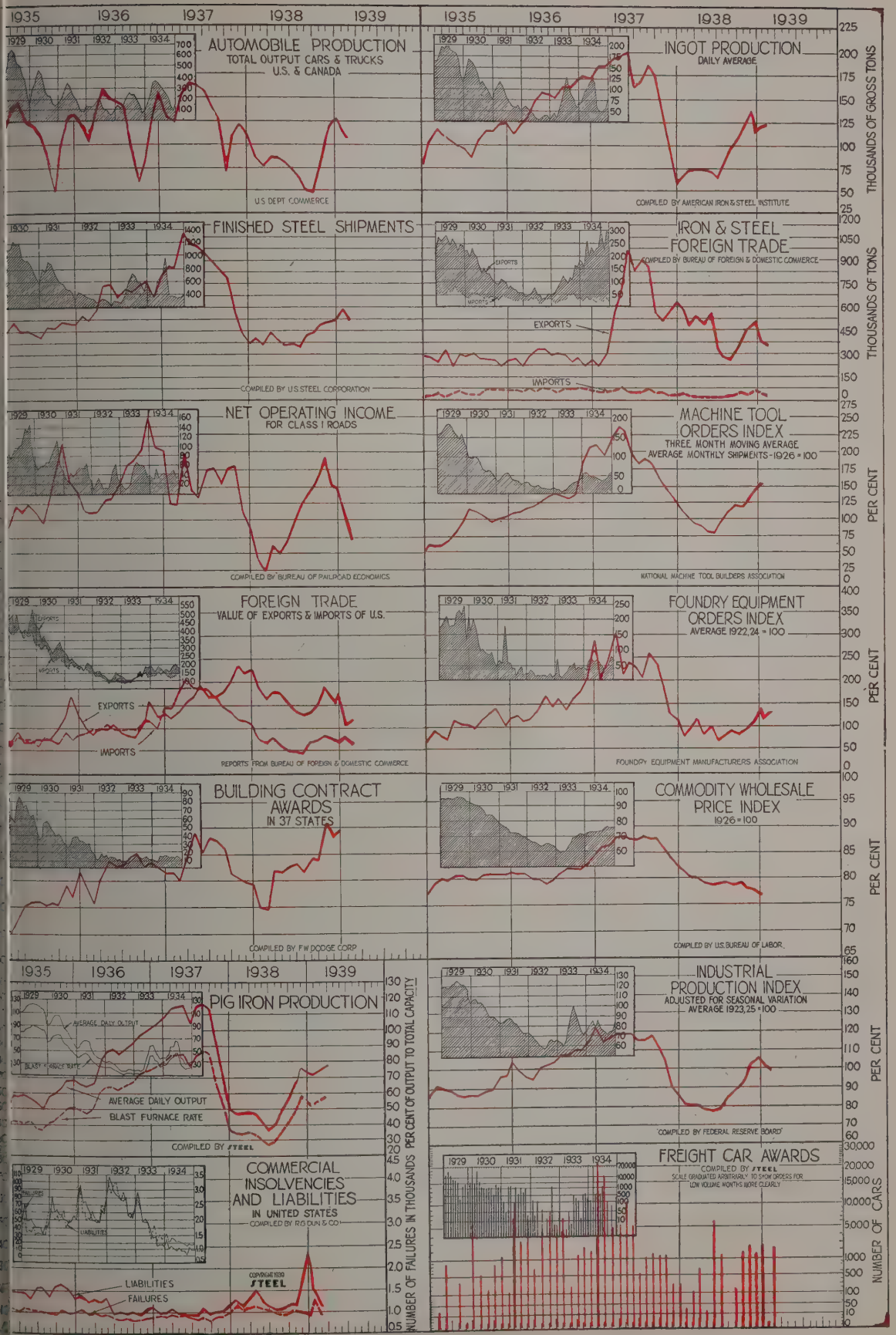








Week ending	Steelworks Operating Rate Per Cent 1938	1932	1929		Electric Power Output Million KWH 1938	1932	1929		Freight Car Loadings Thousands of Cars 1938	1932	1929		Weekly Auto Output 1938	1932
Dec. 24	52.0	12.0	63.5		2,362	1,554	1,860		574	495	843		92,890	27,396
Dec. 31	40.0	13.0	38.5		2,120	1,415	1,638		500	407	638		75,215	25,598
	1939	1938	1932	1929	1939	1938	1932	1929	1939	1938	1932	1929	1939	1938	1932
Jan. 7	51.5	26.0	25.0	84.0	2,169	2,139	1,619	1,542	531	552	573	799	76,685	54,084	30,755
Jan. 14	52.0	29.0	26.0	82.0	2,269	2,115	1,602	1,734	587	580	572	914	86,925	65,735	31,416
Jan. 21	51.5	30.5	27.0	83.0	2,289	2,108	1,598	1,737	590	570	562	932	90,205	65,418	29,365
Jan. 28	51.5	33.0	28.5	84.0	2,292	2,098	1,588	1,717	594	553	560	926	89,200	59,365	28,950
Feb. 4	53.0	31.0	28.5	85.0	2,287	2,082	1,588	1,728	577	564	575	947	79,410	51,443	27,110
Feb. 11	54.0	30.0	27.0	86.0	2,268	2,052	1,578	1,726	580	543	562	956	84,500	57,810	29,320
Feb. 18	55.0	31.0	25.0	88.0	2,249	2,059	1,545	1,718	580	536	572	958	79,860	59,100	30,410
Feb. 25	55.0	30.5	25.0	83.0	2,226	2,031	1,512	1,699	561	512	636	907	75,660	56,977	30,150
Mar. 4	56.0	29.5	25.0	89.5	2,244	2,036	1,519	1,707	599	553	560	977	78,705	54,440	31,390
Mar. 11	56.5	30.0	25.5	94.5	2,238	2,015	1,538	1,703	592	557	575	946	84,095	57,438	31,110
Mar. 18	56.5	32.0	24.5	94.5	2,225	2,018	1,537	1,687	594	540	585	958	86,725	57,558	30,590
Mar. 25	55.5	35.0	23.0	94.5	2,199	1,975	1,514	1,683	605	573	561	961	89,400	56,800	32,892
Apr. 1	54.5	36.0	23.0	95.0	1,210	1,979	1,480	1,660	604	523	545	967	85,980	57,500	35,756


1935 1936 1937 1938 1939
AUTOMOBILE PRODUCTION
TOTAL OUTPUT CARS & TRUCKS U.S. & CANADA
U.S. DEPT. COMMERCE
INGOT PRODUCTION
DAILY AVERAGE
COMPILED BY AMERICAN IRON & STEEL INSTITUTE
THOUSANDS OF GROSS TONS
FINISHED STEEL SHIPMENTS
COMPILED BY U.S. STEEL CORPORATION
IRON & STEEL FOREIGN TRADE
COMPILED BY BUREAU OF FOREIGN & DOMESTIC COMMERCE
EXPORTS
IMPORTS
THOUSANDS OF TONS
NET OPERATING INCOME
FOR CLASS I ROADS
COMPILED BY BUREAU OF RAILROAD ECONOMICS
MACHINE TOOL ORDERS INDEX
THREE MONTH MOVING AVERAGE
AVERAGE MONTHLY SHIPMENTS - 1926 = 100
NATIONAL MACHINE TOOL BUILDERS ASSOCIATION
PER CENT
FOREIGN TRADE
VALUE OF EXPORTS & IMPORTS OF U.S.
EXPORTS
IMPORTS
REPORTS FROM BUREAU OF FOREIGN & DOMESTIC COMMERCE
FOUNDRY EQUIPMENT ORDERS INDEX
AVERAGE 1922,24 = 100
FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION
PER CENT
BUILDING CONTRACT AWARDS
IN 37 STATES
COMPILED BY F.W. DODGE CORP.
COMMODITY WHOLESALE PRICE INDEX
1926 = 100
COMPILED BY U.S. BUREAU OF LABOR.
PER CENT
1935 1936 1937 1938 1939
PIG IRON PRODUCTION
AVERAGE DAILY OUTPUT
BLAST FURNACE RATE
COMPILED BY STEEL
PER CENT OF OUTPUT TO TOTAL CAPACITY
INDUSTRIAL PRODUCTION INDEX
ADJUSTED FOR SEASONAL VARIATION
AVERAGE 1923,25 = 100
COMPILED BY FEDERAL RESERVE BOARD
PER CENT
COMMERCIAL INSOLVENCIES AND LIABILITIES
IN UNITED STATES
COMPILED BY R.G. DUN & CO.
LIABILITIES
FAILURES
COPYRIGHT 1939 STEEL
NUMBER OF FAILURES IN THOUSANDS
FREIGHT CAR AWARDS
COMPILED BY STEEL
SCALE GRADUATED ARBITRARILY TO SHOW ORDERS FOR LOW VOLUME MONTHS MORE CLEARLY
NUMBER OF CARS

Forum on RE-EMPLOYME

■ WHAT TO DO about unemployment, pending changes in economic policies which seem to be hindering recovery, is the theme of this week's Forum contribution.

According to the author, the answer lies in the development of new products, and he cites as proof the recent achievements of several well-known companies which have entered actively into new product development.

Charles H. Oppenheimer is especially well fitted to the discussion of this subject, being president of Designers for Industry, Inc., a product development consulting organization with offices in New York, Cleveland and Chicago. He was graduated from the University of Pennsylvania; served as planning engineer with the Goodyear Tire & Rubber Co., Alexandria Aircraft Corp., and at the Naval Aircraft factory in Philadelphia; and was vice president of Enterprise Electric Lighting Fixtures, Inc. in Cleveland.

Mr. Oppenheimer says: "New products and the training of workers to make them will—I believe—solve the problem of unemployment. What a few industries have accomplished in increasing sales, employment and profits during 1938, can be duplicated by thousands of others if the proper steps are taken in a scientific and thorough manner.

—The Editors

■ IN THIS Forum, the various causes of unemployment have been dealt with in detail, but business men generally would seem to be agreed that New Deal policies are cause No. 1.

What to do about it, pending changes in these policies, is most important to millions of people in this country—and perhaps even more important to business. That some businesses definitely are doing something about it is verified by the fact that last year nearly $300,000,000 was spent in industrial research alone. Over 1700 companies maintained organized laboratories with a personnel of 32,000 trained men.

Over 1000 of these laboratories have been started since 1920. They are spread unevenly over industry, half of the research workers being confined to only seven industries. What are the other 345 separate industries doing? Are the older industries going to allow the new ones to take their markets? While it is true that many companies could not possibly afford a large research department, it is good business insurance for them to spend some money either within their own organization or with an outside service organization.

That such work produces tangible results is indicated by the fact that of the 1937 sales of du Pont, 40 per cent were from new lines developed within the last ten years; of Armstrong Cork, 24 per cent from new products developed within the last seven years; of Johns-Manville, 43 per cent from products either new or improved within the l years. General Electric r that about 60 per cent of the ucts were unknown in the ten years ago. Without the products these companies wo today be employing the nur men they are.

Chicago Flexible Shaft Co. ed a net profit of $1,683,763 f as compared with a net p $1,120,947 in 1937. Much gain can be attributed to th duction of a new produ Shavemaster electric razor. roid Corp., Boston, Mass., that during the year, 1938, er were increased in number proximately 100 per cent due introduction in April of the P desk lamp; in June, the P glass-inspection polariscope; i Polaroid sight-conditioning w (first installation on the Uni cific streamliner "City of L geles") and in December, P day glasses.

One of the largest air-condi equipment manufacturers re net increase of 10 per cent payroll for 1938 due to new ucts introduced in the mo March and June, resulting in volume of over $700,000 in in business for the year. In Ma the Detrola Corp. placed new wee" radios on the market, ing in an increase of 25 p in total volume for the year w proximately the same incre employment.

Diebold Safe & Lock Co., C O., is one of the old-line com not satisfied to wait for p changes. Instead, it forged with the introduction of the hour depository in January, the Eldoorobe in April; se drawer visible file and re panels in May; the Invalift, a Cardineer and Reveldex reco

September. These not only nt new products but diver- n as well, even to the ex- going into lines that did not the old sales channels.

usly it is impossible to re- of the new products intro- during 1938, some of which get on the market in time accurate forecast of sales. 166,000 manufacturers in this , many did not introduce any oducts or improvements on resent products during 1938. these manufacturers in par- that I address this message. y are in many cases not build- the future and not placing lves in position to employ people.

of many new things which e proposed to you only a percentage are likely to be sful. If you have tried get- new product and it has not out well, examine closely the transaction and you will usu- d that you failed to consider more vital facts. One of the hings you must be sure of Will it fit into the organiza- Is it the type of product that esent personnel can interest lves in to the fullest extent? ey 'live' with this product?"

Determining Affinity

of the factors that determines ffinity" of one product for r is similarity of prime cost relation of total direct labor aterial to selling price. It in- a similarity in basic thinking uired for profitable operation. of plant and equipment are lly important but rarely as im- t as some intangibles like the ence of the management and factory personnel, its skill and l equipment, the "know how" organization, or the contacts arkets with which the sales ment is familiar. It is only a thorough inventory is taken se hidden assets that it is pos- to look effectively for any- —or what is more important— gnize it when it is located.

have found that an outside int—a combination of vision rganizing ability, a combina- f engineering and sales train- concentration of time and en- n the task—is productive of t thinking. You can not be orough in the initial work of g the project and its limita- utilizing industrial engineers ant and equipment informa- nerchandisers for market and hannels investigations, and all ntacts available with manu- ers, laboratories and invention s both in this country and l.

n a product seems to have all factors that are required for

Chas. H. Oppenheimer
President
Designers for Industry, Inc.,
New York

your conditions, do not spend money on its development until you first investigate. Market research, when in competent hands, is worth more than it costs in every case. It will reveal the possible market, the right prices class, the right design, etc. With this information at hand, you are in position to make a sound decision, and on the basis of this information, to develop a product that will receive favorable buyer reaction.

It is possible to find new products in a scientific way. New products will assist in increasing or holding the volume of business required, or in replacing business that is no longer profitable. New products can be an asset to steady employment by diversification of production. New products are not necessarily radically new in the sense that they have never been made. It is quite possible to reach an entirely new market with a product already established, by introducing new devices, new utility or new methods that greatly reduce costs.

In the development of new products many a concern has in the course of time developed an entirely new business, employing a complete staff and many employes separate and apart from the previous business of the company. This in turn may even lead to the establishment of an entirely new industry with plants throughout the country, each one employing a large number of men and women. The growth and profits of such businesses are quite apt to be better than of old industries.

The wants of people are limitless and their ability to buy was never more in evidence than it is now. The newly employed will help the old industries and the old industries will help the new. The whole thing hinges on the creation of new products that are needed by the public or which can be sold because they give greater utility, greater convenience or increase the efficiency of industry.

New products and the training of workers to make and sell them will—I believe—solve the problem of unemployment. What a few industries have accomplished in increasing sales, employment and profits during 1938, can be duplicated by thousands of others if the proper steps are taken in a scientific and thorough manner. If each of the 166,000 manufacturers would add one new product, each would employ an average of 30 new people. Service industries would then absorb the balance and so the problem of unemployment would disappear.

Double Welder Mounting Saves Space

■ **Mounting one single-operator welding set above another, as shown above, has been found to be a simple means of cutting floor space requirements and maintaining an orderly welding section. Stand on which machines are mounted is easily fabricated from steel plates 1-inch thick, some 3-inch pipe and through-bolts. It may be placed adjacent to a wall or between operators, eliminating a confusion of single machines about the welding floor. Photo courtesy Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.**

Nameplate

With S

Production of decorative metal parts comb intricate stamping and forming operations interesting finishing techniques. Many port are inlaid with highly colored enamels; synthetic and vitreous types used

By **FRANK FOX**
Fox Company
Cincinnati

■ MANUFACTURERS of automobiles, refrigerators, stoves, machinery, household appliances, radios and other products are making extensive use of escutcheons, nameplates and decorative metal parts to increase the merchandising appeal of their products. Such parts are made of nonferrous metals as well as cold-rolled or stainless steels.

These articles are of three different types. They may be embossed and beautifully finished in chrome, inlaid with baked or synthetic enamels, or inlaid with lustrous colorful vitreous enamels.

Vitreous enameled products are much in demand due to their eye-appealing beauty and to their immunity from heat, cold, acids and the elements. The metal from which these articles are embossed is a special bronze consisting of 9 per cent copper and 10 per cent zinc.

First operation in their manufacture is to make the stampings. These are either simple or complicated shapes—flat, modeled or with radii. In the first operation the metal is blanked, after which the blanks are fed into stamping dies that emboss the intricate designs.

To bring out fine details, these stampings may be embossed several times. They usually are annealed between the stamping tions. After each annealing, ings are treated in acids to the scale and oxides.

Stampings now are trimme forated and formed. The the article determines the press and tonnage needed fo cation. Every variety of p employed from the smallest presses to huge, straight sic bossing presses; toggle or sion presses; and forging ha with pressures up to 1000 to

Dies and tools necessary fo ufacturing these pieces are accurately from blueprints fu by the buyer or from sketc the proposed products. Emb dies may be cut by hand, or in graph or duplicating ma while the tools are made newest type equipment at speed.

Attachments Added

When stampings are com attachments such as studs, s trimount fasteners, pins or spe pins are fastened to the rear. attachments are silver solde 1200 degrees Fahr. either in matic furnaces or with hand to Whenever possible, these are spun or fabricated in the Soldering is done with a mixt hydrogen and oxygen which a fine bond without melting t ticles.

From the assembling depar articles move to the enamelin sion. Those plates to be inlai

peal

tic enamels go to a dust free, nditioned, spraying depart- Synthetic enamels are d through perfectly fitting tes and masks. These mate- hen are baked carefully in ally controlled conveying which are automatically held ct temperatures. After this, mels are highly polished and

Enamels Inlaid

e articles to be inlaid with s enamels are first sent to aning department where the ninute particle of scale and must be removed carefully. and other cleaning compounds ed for this work. Vitreous s employed for this process ade largely in America, but ew colors are imported from s sections of the world. These s, free from clay and foreign nces, are ground to exacting s.

eous enamels are inlaid by s methods. Some are sprayed h templets and masks. Oth- sifted onto the work. Some led in the depressed portions d, using small spatulas.

r the enamel is inlaid, the s are preheated. This is fol- by firing at 1200 degrees Fahr. omatically controlled, continu- onveyor type furnaces. To nsate for distortion caused tremendous heat, the plates eformed to fantastic shapes t the firing causes the plates rn to their proper radii.

imes it is necessary to inlay le color, fire it, then repeat erations with each successive This is necessary especially using dainty pastel shades nsparent colors.

r the firing operation, the sur- namel is ground "flush" with

Mesh belt takes work through continuous enameling and annealing ovens like this at the Fox plant

the metal portions. This grinding may be done by hand or mechanically. It usually requires several different size grits in grinding wheels so final grinding will leave the enamel and metal portions quite smooth.

Articles now receive a second firing. After scale and oxides have been removed, they are taken to the pumice division where high speed felt wheels, charged with various grades of pumice, add luster to the enamels and remove grinding marks from the metal portions. Following the vitreous enameling operations, the work is moved to the buffing and coloring departments where the plates receive a mirror finish.

The products now move to the plating division where they are sent through degreasers or hand scrubbed in cleaners to remove the polishing compound, making them chemically clean and ready for electroplating. Any number of finishes are available in the plating department including brass, bronze, oxidized nickel, chromium, silver and gold.

The most popular finish is bright chromium. To secure this finish, the articles are first plated with a 0.00025-inch thickness of nickel. Then they are plated with a 0.00015-inch thickness of chromium.

Extremely strict control is necessary in the plating as well as the enameling and cleaning divisions. A chemist and a modern laboratory are provided to establish and check correct procedure. A number of nameplates, escutcheons and decorative metal parts made by Fox Co. are shown in accompanying views. These indicate the wide variety of sizes, types, shapes and materials involved.

The new plant just recently completed contains approximately 100,000 square feet floor area and has more than 100 presses, several hundred polishing lathes, many large plating tanks, dozens of furnaces, a large number of soldering torches and new equipment of every description. Also there are several new, conveyor type, electrically controlled, heating ovens, one of which is shown in an accompanying illustration.

More than 500 artisans produce some 50,000 pieces daily. Work is moved throughout the plant on conveyors wherever possible. Shipped to all parts of the world, these products add sales appeal to many items.

•

Thin Enamel Coatings Have High Opacity

■ Described as ultra-opaque sheet iron cover coats and designated as Ultrapaque No. 1313, a new line of porcelain enamels has been developed by Ferro Enamel Corp., Cleveland. It is said these enamels are applied in a coating 40 per cent thinner than that required with ordinary enamels with no loss in opacity or covering power. Other advantages claimed are increased resistance to mechanical shock, deflections and scratching, and the production of enameled sheets that shear neatly with no chipping back from the edges.

This type of enamel is supplied in powdered form. In the enameling plant it is necessary only to add water to this powder in the m
then grind to a dry residue of
1 gram on a 325-mesh sieve
cause of its fine particle siz
type of enamel is said to spra
easily, stay in suspension
readily and cause less we
spray equipment than more
ly milled porcelain enamels.
at slightly lower temperature
standard cover coats but oth
can be handled in the usual

Contribute to Techn
Of Enameling Metals

■ In order to clear up some
tainties as to the cause for f
of enameled ironware due t
ferential contraction betwee
enamel and the iron base, W. N
rison, B. J. Sweo and S. M. S
of the bureau of standards,
ington, recently conducted a
of experiments.

After studying the behavio
large number of ground-coat
els during heating and c
cycles, they derived constant
each one which, when substitu
simple first-order equations, p
computation of the expansiv
each frit at any stated temper
or in any temperature interv
tween 77 degrees Fahr. and th
ical temperature.

Handbook of Welding
By German Authority

■ *Practical Handbook of the
Welding Technique* (Prakt
Handbuch der gesamten Sch
technik), by Schimple-Horn;
koid, 300 pages, 6 x 9 inches;
lished by Julius Springer, B
Germany; supplied by STEEL,
land; in Europe by Penton Pu
ing Co. Ltd., Caxton House,
minster, London, S. W.1.

This book, which is in Germ
the third edition of Part I o
practical phase of welding
nique, and is concerned with
welding and cutting techniqu
is divided into eight chapte
which the introduction disc
generalities of welding and
welding, special new welding
esses, review of arrangement c
welding plants, and important
erties of weldable metals.
II deals with specific equipmer
gas welding and describes we
gases, and welding accessories.
nique of gas welding is descri
detail in Chap. III while sold
with a welding torch is cover
the next chapter. Torch cutti
dealt with in Chap. V, and
advantages of welding seams
their testing is described in
VI. Chap. VII and VIII d
capacities and costs of gas we
processes, and advancement of
ing technique.

Pure Iron Powder

Direct Reduction from Ores and Scale at Low Temperature Nearing Long Sought Goal

Advances in powder metallurgy one phase of potential market in which rapid strides presage early erection of domestic plants for economical production of iron

By A. H. ALLEN
Detroit Editor, STEEL

TECHNICAL literature, other than patents, on the subject of commercial production and use of powdered or sponge iron is sparse; yet metallurgists and engineers have "fooled" with the matter for a score of years or more. It appears that just now a number of important uses for powdered iron are being proposed, but with the supply limited largely to Swedish sources, progress is being stymied for economic reasons. Hence STEEL has undertaken to examine the historic ramifications behind research work in the development of commercial sponge iron production methods, and the possible outlets for the material. It is demonstrated that reduction of iron oxides by low-temperature processes, far from being a metallurgist's pipedream, may even now be on the threshold of an important new industry in this country.—The Editors.

ICKENING of activity in the f metal powders and a broad- derstanding of their metal- suggest a review of how pow- metals—especially iron—are ed from their oxides, of the and experimental work in- in these reduction processes, some latterly-perfected uses ture possibilities.

aration of oxygen from metal- ments, as in the reduction of usually involves the high tem- res of the blast furnace, open and electric furnace. Per- nothing has stimulated ad- g civilization to the extent he development and tion of high-tempera- reduction methods But these high-tem- re processes tolerate lective reduction of lic oxides; they are, in "melting pots" and cally all of the re- e metallic oxides pres- gether with some of nmetallic oxides, may und reduced and al- wholly or partly, ach other. The prob- metals separation, or s elimination then be- important, if the pro- n of a single, pure is the aim.

- temperature reduc- esults in selective re- n of certain metallic s present in nearly commercial product, his initial selectivity brings a more effective separation of constituents than is possible when all the products are alloyed. This primary separation of the principal metal from other constituents is distinctively characteristic of low-temperature reduction.

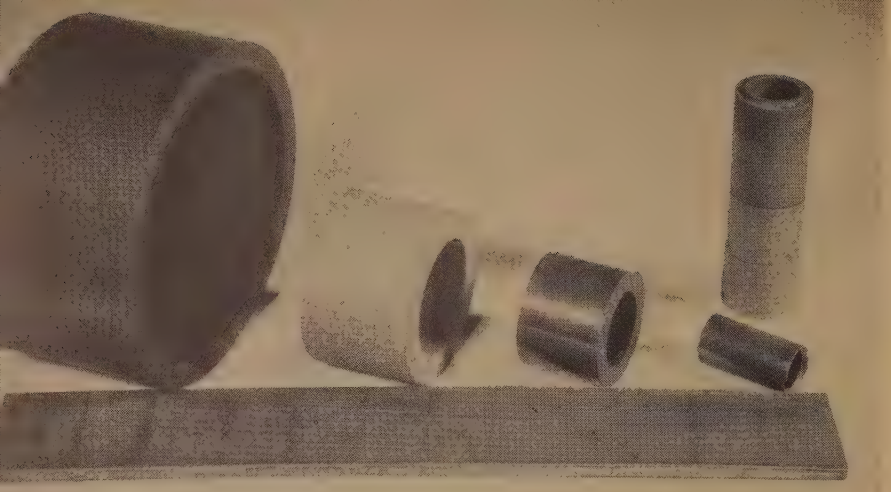
In general, low-temperature reduction of metallic oxides is carried out at a temperature below the sintering point of the constituents of the charge and without addition of fluxes. Thus, if there is to be no fluxing action, other separation methods must be employed. These group themselves about as follows:

1. Magnetic separation	No heat involved
2. Gravity concentration	
3. Oil flotation	
4. Metallic vaporization during reduction	Heat added
5. Fusion of the "end" metal during reduction	

It should be stated that after steps (4) and (5) the metal or metals produced may be separated from each other and from gangue constituents by resort to (1), (2) or (3). It is also possible to produce certain metal powders by atomization and by electrodeposition, methods which are not considered in this discussion.

Iron Oxide Reduction

For at least 20 years, investigators and research workers have been intrigued with the idea of producing iron without the aid of the blast furnace. Large sums of money and long years of labor have been expended to this end, without much practical success. Many experimenters have been obsessed with the delusion the goal was simple to attain, that their success was a foregone conclusion, that their rewards would be rich. Others were spurred on by an eagerness to "put the blast furnace out of business," and so feverish were their efforts



Samples of bushings and flat "new iron" prepared by the reduction method. Parts are by briquetting, sintering and the pure iron powder

that they took on more the aspects of crusades than of studied research. Suffice to say, the day of the blast furnace still is far from drawing to a close, despite progress made in the direction of low-temperature reduction of iron ores.

The proclaimed purpose of most low-temperature reduction enthusiasts has been to obtain an iron with qualities superior to that produced by the blast furnace. By common usage this product has been termed sponge iron, a name probably derived from the physical characteristics of iron made by ancient methods practiced prior to the introduction of the blast furnace. Investigators are in substantial agreement that iron produced by low-temperature reduction methods has qualities which make it superior to many products made from pig iron. But, the commercial success of a low-temperature reduction process and its product in this country have yet to be demonstrated.

Practical Method Near

Perhaps few persons are more qualified to speak with authority on the subject of sponge iron production than H. G. S. Anderson, now residing in Muskogee, Okla., and for 22 years almost continuously engaged in development and exploitation of processes and apparatus for low-temperature reduction of various metallic oxides, principally iron.

For this reason this editor of STEEL has visited with Mr. Anderson, watched his experiments with pilot plants in Oklahoma, and has reviewed extensively his work with and observations on sponge iron production. It appears, as a result of this investigational work, that Mr. Anderson now has a commercially practicable production method, awaiting only a sufficiently large and steady market for the product.

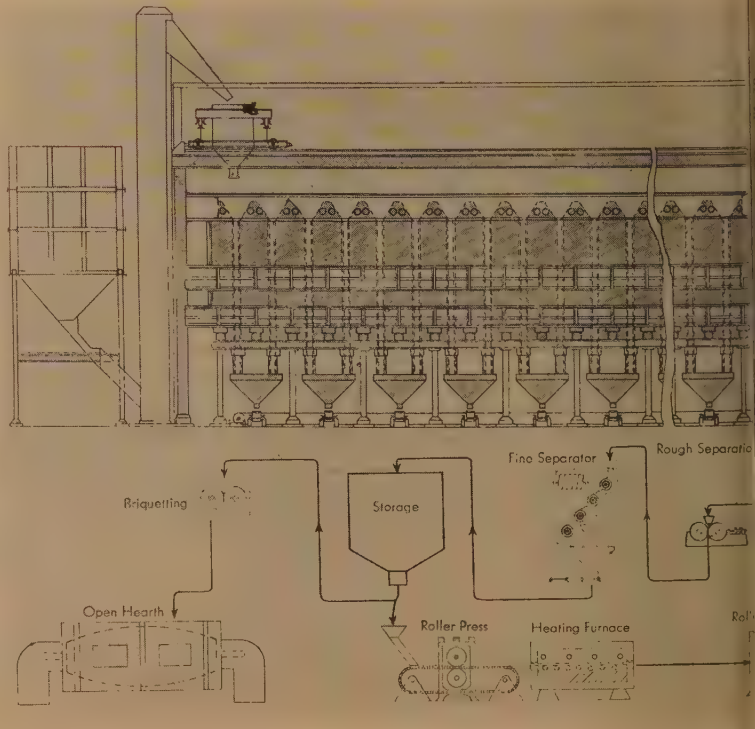
Foundation of Failures

Two decades of metallurgical pioneering in low-temperature reduction have witnessed a good many more failures than successes and, ironically, such success as has been achieved has been built upon a foundation of failures.

Going back to the beginning of the development, the need for a sponge iron or iron powder first was occasioned by the demand for a fine precipitant for copper from copper sulphate solution in the treatment of the mixed oxide-sulphide copper ores of the Chino Copper Co. in New Mexico. Now that most copper ores are of the sulphide variety this need has disappeared, but in the early leaching of copper ores a finely-divided iron was es and metallurgists discovere powder was not so readily able in the open market as th assumed.

Subsequent investigation di a method long used by the C to produce sponge iron. Firec torts were filled with iron o coal, heated for a few days, a to cool to atmospheric tempe and then were broken open tain a spongy, sintered mass o coke and gangue, obviously u to provide a source of fine iro der. Further search revea Swedish company also to be n sponge iron in fireclay pots interest used a high-grade crushed magnetic iron ore was alternated with coal in until each pot was filled. Th then were covered with firecla and placed upon cars which through straight-line brick during which time the pots heated to a reduction temper This process produced a better of sponge iron, not mixed wit and containing little gangue, b iron particles were welded to and required fine grinding iron were to be used as a coppe cipitant.

These disclosures, made years ago, left no path open b



Iron ore reduction and processing plant of coke oven type proposed by the late William H. Smith. Chief difficulty with this unit was in accretions forming on the oven walls and bridging across them

ading to development of a new
s for reduction of iron oxides
tain a pure iron powder. No
ceived ideas as to equipment
applied, and the work neces-
had to start from scratch.
r a period of several years
es were built ranging in size
laboratory to semicommercial
ommercial units. Each design
ested thoroughly to determine
mmercial practicability, and
any design was abandoned a
v of favorable and unfavorable
ts was prepared to avoid the
pitfalls in subsequent equip-
Types of furnaces erected
sted in this period included:

The by-product coke oven type.
The cylindrical rotary-kiln type.
The cylindrical steel tube, with
internal transport screw.
Various resistance-type electric
urnaces.
Rotary-hearth muffle furnaces.
a. Circular hearth, heated with fuel burned in silicon carbide tubes.
b. Annular hearth, heated with fuel burned in silicon carbide tubes.
c. Circular hearth, heated with fuel burned above a silicon carbide tile arch sprung over the rotary hearth.
d. Circular hearth, heated through silicon carbide tubes, and with reducing gas fed up through hearth.

is of interest to review the re
obtained with each of these
. The by-product coke oven type
involved ovens from 20 to 35
in height, built first of fireclay
ater of silicon carbide. In each
nce iron was produced, com-
ly reduced, from iron ore and
coal charged at the top of the
t and allowed to descend in the
d oven at proper rate of speed.

Accretions Formed

wever, at no time during tests
these ovens, extending over
y months, was it possible to
the charge or iron ore and coal
nding in the ovens longer than
urs without welding of the par-
s of iron and the formation of
tions on the sides of the ovens.
he point where reduction of the
oxide was complete, the hot
llic iron always adhered to the
of the oven, arresting descent
he charge and continuous pro-
on of the iron. Temperatures
e ovens were lowered, but accre-
continued to form, although at
wer rate. As a result of the
r temperature, production was
ced to a point where it became

patently too small for the capital investment.

Accretions on the walls of the oven gradually formed a "bridge" of hot, welded iron from wall to wall which always adhered so tenaciously that it was impossible to dislodge it without breaking the walls, after which it became necessary to cool the furnace, dismantle the oven and erect a new one.

Graphite Lining Helps

This welding of the iron particles in the oven was believed to result from the fact that during reduction from iron oxide, the iron swells to a greater volume than the original oxide. This volume increase, together with the pressure of the overlying charge, and the temperature of the hot iron, produces the incipient welding.

It was noticed that hot sponge iron, at the instant of reduction from the oxide, adhered to every solid substance, carbon excepted, with varying degrees of tenacity. This led to the decision to line the oven with graphite to prevent accretions, and to abandon the conventional rectangular cross section in favor of a circular cross section, because of the greater ease in fitting an annular section of graphite, 1-inch thick. The new retorts were of silicon carbide, 12 inches in diameter and 20 feet high.

A good grade of sponge iron was produced in this graphite-lined design for a period of one week, but at the end of the seventh day it was discovered the graphite lining had disappeared entirely at an elevation in the retort where maximum reduction of the oxide occurred. A bridge then formed across the silicon carbide retort and soon plugged it.

In this connection it is perhaps pertinent to make reference to work which the late William H. Smith did with this type of reduction unit. For a time connected with the automobile industry, he later supervised the erection of a reduction plant of the coke oven type at the Ford Motor Co., later dismantled. He claimed to be able to process an iron ore containing 38 per cent Fe into so-called "new iron" with only sufficient gangue remaining to satisfy the quantity of slag required in steelmaking, and practically free from gases, phosphorus and sulphur.

Later organizing the General Reduction Co., Detroit, Smith until his recent death was vociferous in promoting his reduction process. Results of Anderson's research with coke oven reduction units, possibly suggest why the Smith process never met commercial acceptance. Too, it appeared that Smith saw in his process a successor to the blast furnace, and despite his protestations that his ideas were being throttled by blast furnace operators concerned about their future, it is just not economically possible to consider low-temperature reduction methods in this category—yet. Smith, however, should be given credit for visioning the possibilities of production of parts from sponge iron by compressing and sintering.

Opposing Factors

Turning now to experiments with the cylindrical rotary kiln type furnace (2), the decision to experiment with this type of unit was influenced by the obviously simple design, the large production in other industrial applications, and the probable low capital cost per unit of daily output. But Anderson's research has convinced him that, in using the rotary kiln to produce sponge iron, the operator attempts to accomplish two diametrically opposite chemical reactions within the same chamber: (a) Combustion of the heating fuel, a highly oxidizing chemical reaction; and (b) reduction of iron oxide, a highly reducing chemical reaction.

As a result, the iron oxide never is completely reduced, or if it is re-

t of dual rotary hearth (preheat- and muffle hearths) furnace ed at Muskogee, Okla., for pilot t testing purposes. Note station- abble arm which extends through furnace and across the hearth, ying silicon carbide rabble blades

duced, the iron is quickly reoxidized by air or carbon dioxide. The final result is the same—partly reduced iron oxide. Seventy-five per cent is said to be a high reduction and even this is difficult to maintain for any considerable length of time.

Citing results of rotary kiln experiments made in 1918: Heating fuel first was burned efficiently, resulting in maximum carbon dioxide content of heating gases. Sponge iron produced contained about 25 per cent metallic iron. Fuel oil burners then were adjusted to produce a reducing flame in which carbon monoxide would constitute a maximum percentage and carbon dioxide a minimum percentage of combustion gases. Reduction of iron improved until it was possible finally to obtain from 60 to 75 per cent metallic iron. The remaining 25 to 40 per cent was discharged as iron oxide—losses too large to permit operation within bounds of economy.

Crushing Necessary

The product discharged from the rotary kiln was a succession of agglomerations of fused and partly reduced sponge iron, magnetic iron oxide, nonmagnetic iron oxide, pieces of coke and gangue from the iron ore. These fused masses had to be crushed before the product could be submitted to magnetic separation. The final magnetic product consisted of 60 to 75 per cent metallic iron, the remainder being principally still adhering magnetic iron oxide and gangue, with some coke.

In later experiments with the muffle-type furnace it was demonstrated the concentration of $CO:CO_2$ should be a minimum of 75:25 for complete reduction. This concentration of gas was never attained in the rotary kiln, and in addition the inefficient combustion of the heating fuel resulted in lower flame temperature which in turn resulted in slower heat absorption by the charge and consequently larger fuel consumption per ton treated.

Accretions Close Kiln

Another obstacle stood in the way of success in the rotary kiln. At the point of maximum iron oxide reduction the charge always adhered to the lining and accretions gradually formed a ring of iron, slag and included coal around the inside periphery. Constant additions finally closed the passage through the kiln so that in a few days it was impossible to pass the charge through.

Subsequently, an attempt was made by United States Steel Corp. to produce iron in the rotary kiln by the Hornsey-Wills process at Lorain, Ohio. C. Harold Wills, now metallurgist with the Dodge division of Chrysler Corp., Detroit, was active in this venture with Hornsey, an interested engineer who had been to England with the process. The project was dropped some time after its inception. Likewise, the Ford Motor Co. met with difficulties in producing sponge iron in the rotary kiln by the Bourcoud process at Detroit. Similarly an attempt to make sponge iron in the rotary kiln by the Onondaga Steel Co , Syracuse, N. Y., met with failure.

It is interesting to recall that the original Hornsey-Wills expe involved the sealing of c lake ore in about a 4-foot ste then heating to the reducti perature and cooling. The mass then was barred out drum and beaten or hamm remove nonmetallic impuriti metal subsequently was m the open hearth, poured int got and rolled into a rail. T produced from direct reduc ore, persuaded executives Steel corporation, it is said, propriate funds for the exp into direct reduction, it is but in later equipment the c ore were not sealed in a cont in the first experiment.

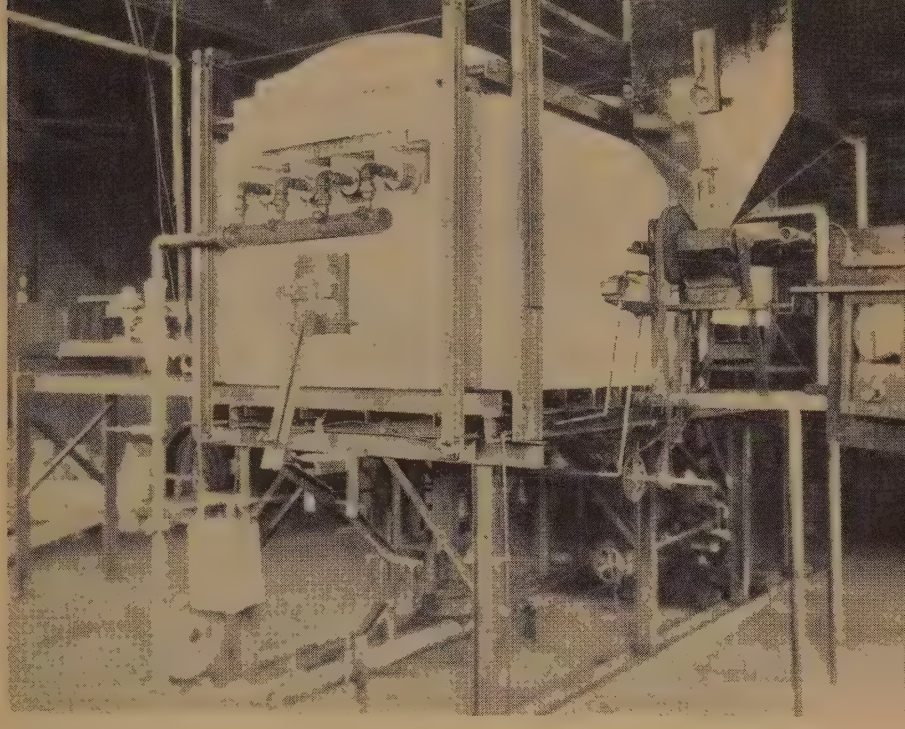
About 50,000 tons of iron, 9 cent pure, were made at Lor cording to Mr. Wills. Ope heats were made with varyi centages—25, 50, 75—of spon in charges. When over 50 p sponge was charged, ingot found to be "dry" with cra corners and unsuited to furth

Try Steel Tube Furna

With the discovery that r conditions are more easil trolled in a retort or muff natural next step was to e possibilities of the cylindric tube furnace (3) with tr screw. The first obstacle whi fronts the investigator is th acter of the material used i of the retort or muffle. Th effective heat conductor wil metal, if it will withstand the ing influence of the heating fl the necessary degree.

Ordinary steel will not last longer than a day or two.

Exterior of pilot plant at Muskogee, equipped with dual 8-foot diameter hearths and coal distillation furnace



muffle furnace of rotary type erected at Muskogee, atural gas as reducing agent. y is 250 to 300 tons of reduced day. Note hopper feed at one abble arm extends across and through opposite side. s burners fire through silicon tubes spanning the hearth. ation the door at the front is n to allow escape of reducing Photo courtesy Quigley Co. Inc., New York

ature alloy steel will last onger, but it, too, will oxidize lly under the high tempera- cessary to obtain a commer- put from the retort. Economy s that temperatures must be ough to produce sponge iron the tube in a reasonably ime—perhaps 10 to 20 min- hese high flame temperatures ary on the outside of the tube ere in their destructive action.

introduces the subject of the of temperature necessary to e sponge iron. Generally, iron nay be reduced to iron begin- t 700 degrees Cent. From 700 degrees the reduction is too for commercial production. ally speaking, an iron ore with on content may be processed mperature of 1050 degrees or y lower. The limiting tem- re is that point at which in- welding or fusion of the takes place and prevents un- cted passage of the charge h the furnace. This limiting rature varies somewhat with nt types of equipment and ifferent types of ores.

luction of sponge iron in a ntal metallic tube is imprac- because of the swelling ac- f the reduced iron. This swell- tion packs the charge tightly transport screw and causes des of the metallic tube to outward, breaking the wall.

Sticking Is A Difficulty

of a rotary inclined metallic is possible but impracticable e of sticking of the sponge inside of the tube. Operation degrees Cent. and at a 3-hour ion period results in prac- no sticking, but it also re- in such a small iron produc- hat the capital investment per f output becomes prohibitive. g temperatures to 900 or 950 es lowers reduction time but ps sticking in a short time.

en the charge is dropped gh a vertical metallic retort ne iron will again weld itself incandescent sides of the re- and gradually bridge across nder operation impossible. this connection an interesting test was made to determine the speed of reduction. Iron ore, crushed to pass 200-mesh and mixed with coal, was showered through 20-foot vertical retorts in which the temperature was 1000 degrees Cent. The time of descent was about 1 second and the resultant iron was completely reduced. This demonstrates that reduction is practically instantaneous if the iron ore is ground finely, if reducing gas concentrations are properly proportioned and if the temperature within the retort is about 1000 degrees Cent.

Electric Furnace Costly

Incentive to develop electrically-heated sponge iron furnaces of the resistance type (4) was not great because in few localities is electric power available at low enough cost to permit economical operation. However, tests were made on furnaces employing metallic resistors, refractory resistors and broken carbon resistors.

Metallic resistors do not permit the furnace to be operated with enough difference in temperature between resistor and charge. Further, the action of muffle gases on metallic resistors is quite deleterious.

Refractory resistors, especially those of silicon carbide, while capable of operating at higher temperatures, are considered too fragile for use in a reducing furnace. Also, restrictions on length preclude the possibility of using them in commercial furnaces in which a hearth width of 20 feet might be specified.

Broken carbon resistors were found susceptible to "hot spots" in the troughs in which the carbon is held. These spots accelerate consumption of the resistor by deoxidation of carbon dioxide. Further the current eventually will short circuit through the silicon carbide trough and thereby decompose the latter and collapse it.

Success attending sponge iron production in muffles led to experiments with circular hearth muffle furnaces heated with fuel burned in silicon carbide tubes (5a). Information gleaned from previous tests with other reduction methods suggested the decision to spread the charge loosely upon a rotary hearth so that it could expand without constriction; to fill this rotary hearth with a bed of carbon to which the freshly reduced hot iron would not adhere; to administer frequent stirrings by means of rabbles; to keep the charge spread thinly upon the hearth, permitting quick penetration of the heat, and to apply the heat to the charge by combusting fuel in a series of silicon carbide tubes supported on silicon carbide arches extending over the hearth.

Small Unit Successful

A small demonstration furnace of this type, 3 feet in diameter was built and operated continuously for two years, producing several hundred pounds of completely reduced iron per day. Then a 12-foot furnace was designed and erected, producing several thousand tons of finely divided and completely reduced sponge iron over a period of another two years.

Ore charge in the latter furnace was magnetite ground to pass 30 mesh and analyzing 60 to 65 per cent iron. Reducing agent was a subbituminous coal containing 15 per cent ash and 40 per cent volatile, which was processed to a semicoke

containing 12 per cent volatile, in a low-temperature coal carbonization plant.

Product was a sponge iron, mixed with excess semicoke and gangue from the ore. Screen sizes of the powdered iron were practically the same as those of the original magnetite charged, demonstrating the absence of sintering or agglomeration. The furnace product was subjected to magnetic separation, resulting in a sponge iron analyzing 90 per cent iron, all metallic.

Because this iron was used for copper precipitation in the copper ore pulp, it was unnecessary to clean it further. When a purer iron is wanted, it is necessary to grind the magnetite somewhat finer and pass the product over the magnetic separator several times to eliminate the fine gangue.

Sponge iron, recleaned magnetically and briquetted without any binder, was used at this time as melting stock for a cupola furnace. Briquets were charged with scrap iron in proportions of 20 to 80 per cent briquets. If more than 80 per cent of the charge was briquets it was found the cupola would not heat the metal hot enough to obtain satisfactory castings. Sponge iron, because of its purity, has a high melting point (melting point of pure iron is 2795 degrees Fahr.), so that it is desirable to mix sufficient scrap to lower the melting point of the charge and improve fluidity.

Product Used Successfully

Thus it was possible at this mining property (Chino Copper Co.), hundreds of miles from the nearest source of pig iron, to substitute sponge iron briquets for pig in the production of plant castings, and to obtain better castings. It was also possible to produce small quantities of steel from sponge iron in a high-frequency induction furnace, it was found.

News of successful operation of muffle-type furnaces for ore reduction spread, and in a short time an engineering firm organized by Anderson was commissioned to design and build a sponge iron plant for Japanese interests, comprising two annular rotating-hearth furnaces (5b) capable of producing 50 tons each of iron per day when treating a beach sand containing 20 to 25 per cent iron of which 3 to 5 per cent was iron as ferrous oxide in ilmenite (containing titanium oxide).

The equipment was erected as a pilot plant by Japanese industrialists who owned the beach sand deposit—an ancient deposit about 800 feet above prese level, covering a large ar often diluted with waste duri ing to bring iron content d low as 20 per cent. This iron posit was said to be the only of iron on the mainland of pire, and it is believed the J government was behind the ties of industrialists seeking commercial use of the ore.

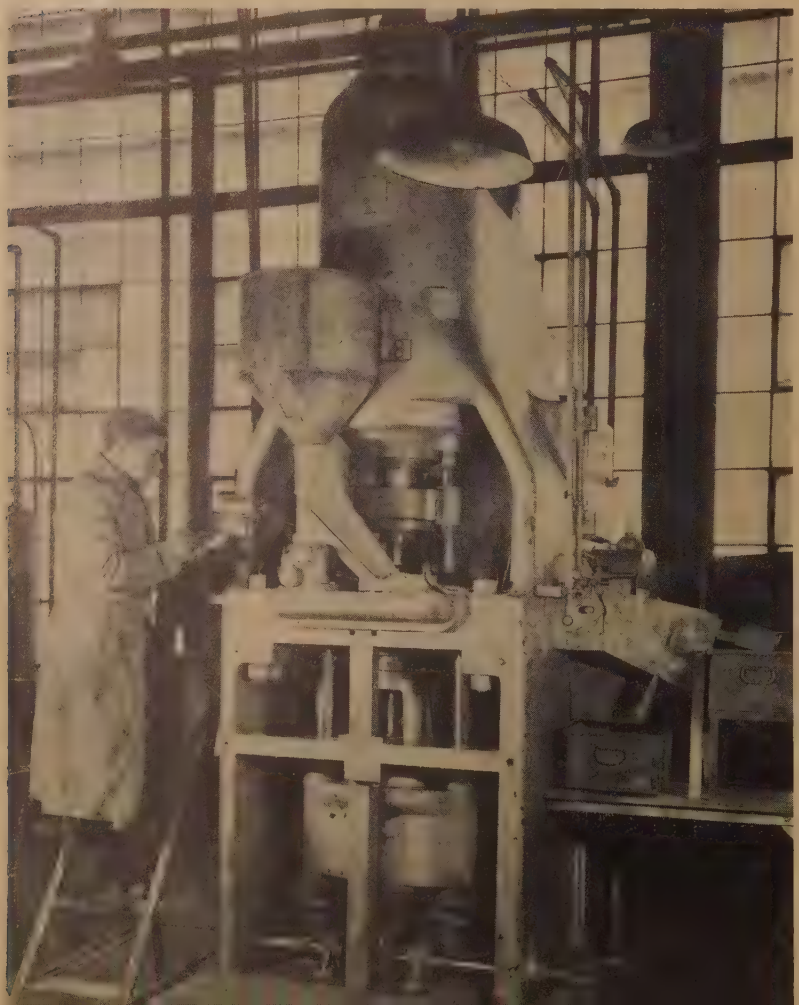
Furnaces were 60 feet in diameter, with annular hearths 12 feet wide. Raw p gas was distributed to through bustle pipes encircl furnaces, the gas burned in con carbide tubes per furnac supported on silicon carbide sprung over the hearths. A radially, the tubes tapered diameter of 10 inches at th edge of the hearth to 6 in the inner edge. Spent com gases were discharged into nular waste gas flue and th multiple-hearth McDougall ing furnace. Heat from th tubes was radiated to the ch ore, sand and semicoke hearth, 30 inches below the The charge, after passing t the preheating furnace gra to the inside periphery of the tion furnace hearth, then rabbled to the outside periph the rotation of the hearth action of eight stationary arms set at angles of 45 around the hearth.

Only 70 Per Cent Iron

Semicoke, containing 12 to cent volatile, was added hearth to the preheated cha reducing the iron oxide. Re sponge iron, mixed with and silica, was discharged steel cylinder rotating in a voir of water and cooled to pheric temperature. The then was passed over m separators, but it was imp to obtain an end-product wit than 70 per cent iron on acc the ilmenite which had bee ered strongly magnetic dur reduction.

The magnetic product briquetted without binder, chanical presses, briquets inches in diameter and 2½ long. They had sufficient stre withstand six rough handli coastwise steamships to Japan, where they were used ducing both open-hearth and furnace steel.

Although circuitous reports



Hydraulic-type briquetting m for initial forming operati powdered metal bearings and specially built for the Ample sion, Chrysler Corp.

indicated the plant to be operation, inadequate prelim- rospecting and development iron and lignite deposits re- n considerable disparity be- riginal estimates and actual classifying the project as ly ill-advised.

Used For Bearings

ecent years, a growing de- for sponge iron for use in ssed-bearing or oil-less bear- ustry has been evident. Both r Corp. and General Motors ow operate divisions active pressing and sintering of iron into bearings for a wide of uses where prelubricated nanently lubricated bearings vantageous. Such uses are ying rapidly, and in addition nents are proceeding along es of perfecting other appli- of pressed and sintered iron ; for example, one current involving the fabrication of otive brake drums in this n. Further, sponge iron has ound to be a valuable water- g ingredient in concrete ag- e for highways.

trend led Anderson to the de- to erect a small, commercial n Muskogee, Okla., to be used ot-plant purposes in the test- y low-temperature reduction, ores, tin concentrates, tung- ncentrates, oxidized lead and es, roasted zinc concentrates igh iron content, nickel oxide, oxide, and the production of ash" by the reduction of spar.

plant, shown in an accom- g illustration, houses a fur- ith two circular hearths (5c), feet in diameter, one a pre- g hearth and the other a hearth, the former 2 feet than the latter and separated eet. A silicon carbide muffle, f matched tile, is sprung over uffle hearth to keep muffle separate from the combus- ases during the reduction.

charge may be added either preheating hearth or directly muffle hearth. During pre- g, the charge is rabbled con- sly from the center to the e edge of the hearth, where it ped off by a discharge-rabble and falls into a hopper h which a water-cooled screw or transports and cools the aterial to atmospheric tem- res. The cooled material then harged into the air through locking device which prevents egress of furnace gases and ingress of air.

Material charged on the muffle hearth is mixed with semicoke and during reduction is rabbled continuously, being discharged into a water-cooled screw conveyor which reduces the temperature to atmospheric. A stationary rabble arm extends through the furnace and across the top of the rotary hearth. To this arm are fastened silicon carbide rabble blades which stir the mate rial on the hearth during reduction.

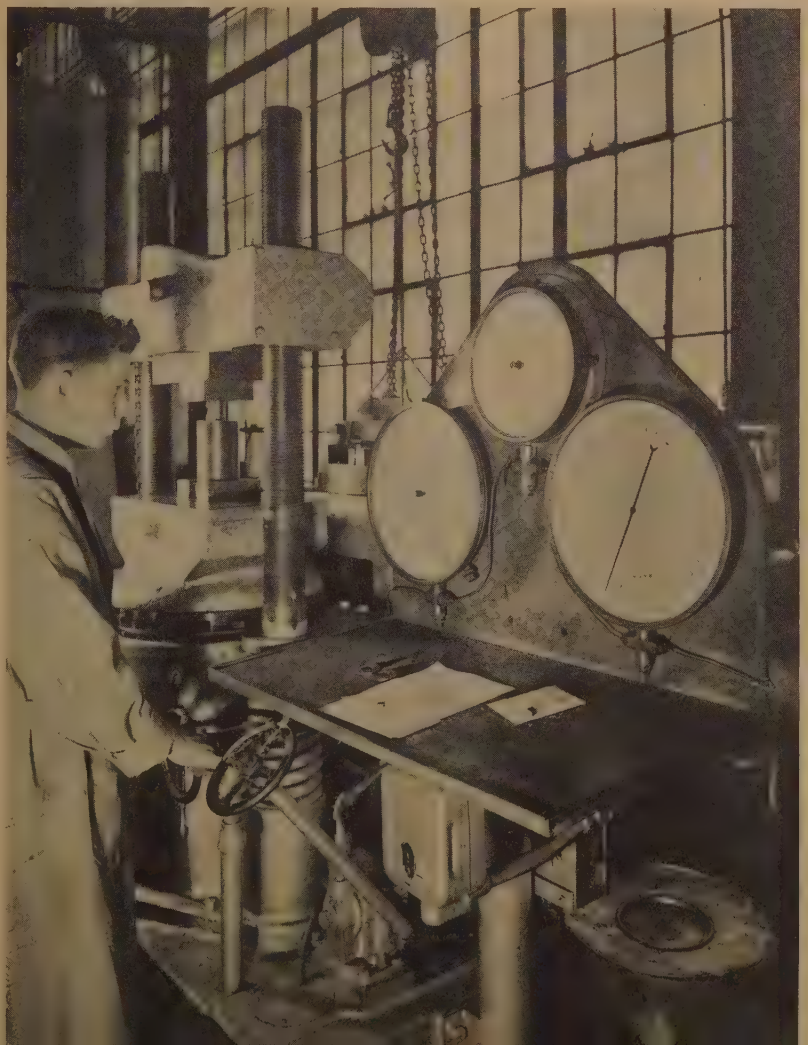
Semicoke is added to the muffle hearth only because it will burn if added to the preheating hearth, inasmuch as the latter is exposed to the open flame of the heating fuel. Heat is supplied by burning fuel oil in a combustion chamber over the top of the silicon carbide tile arch. The heat is conducted through the arch and radiated to the moving charge on the rotary hearth. The reduction action within the muffle generates carbonaceous gases which induce a gas pressure of several hundredths of an inch of water. This pressure expels the muffle gas continuously to the atmosphere through a port in the wall of the muffle and prevents ingress of air.

Reduction on the muffle hearth proceeds in from 10 to 20 minutes if the ore is ground to 35 mesh. The product, consisting of finely divided iron, excess semicoke and gangue from the iron ore, is passed over a magnetic separator to eliminate the nonmagnetic waste from the iron, leaving a sponge iron ready for use. If it is to be melted in a furnace or is to be transported in other than powdered form, it is advisable to briquet the material; otherwise it is sacked for shipment.

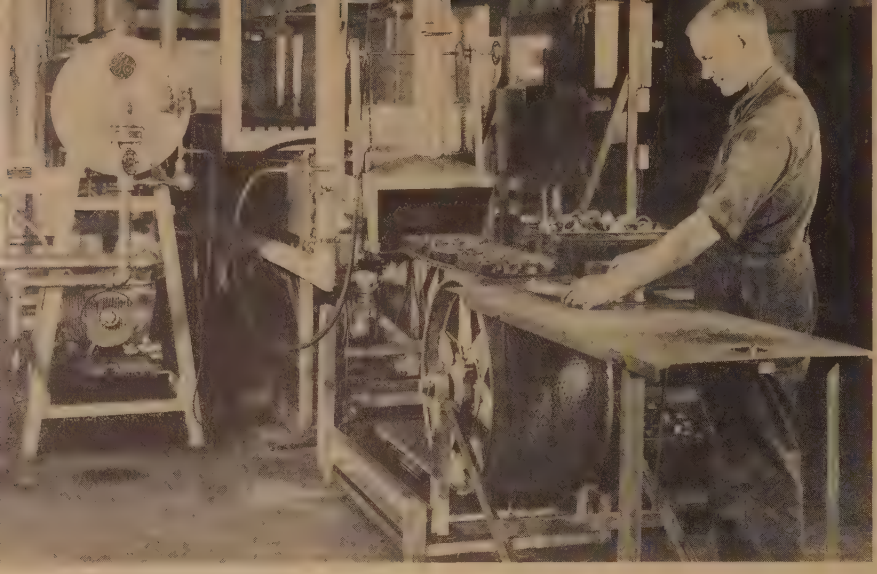
Obtains 98 Per Cent Iron

Sponge iron, reduced in this furnace from mill scale (of which there is a plentiful supply in steelmaking districts) contains from 96-98 per cent iron. Sponge iron, reduced from ores, may contain anywhere from 80 to 98 per cent iron, depending upon the degree of intimate association of the iron oxide and the gangue of the iron ore. By grinding the ore to a finer state it is often possible to liberate more gangue.

More recently, it was decided to investigate the possibilities of natural gas as both a heating fuel and reducing agent, there being an abundant supply of gas at low cost in Oklahoma. A second pilot plant was erected at Muskogee, somewhat smaller than the one just described, but similar in construction, except



-duty hydraulic powdered metal tting press at Amplex division, ler Corp. Gages at the right e accurate indication of pres- sures



Controlled atmosphere electri
nace with mesh-belt conveyor u
sintering pressed powdered
parts at Moraine Products di
General Motors Corp., Dayt
This view is the discharge end
20-foot cooling chamber. Bel
inches wide, door opening 8
high, heating chamber 10 feet
rating 102 kilowatts, maximum
ating temperature 2100 degrees
Combustion-type atmosphere
ator is shown at left. Photo co
General Electric Co.

that only one rotary hearth is used. The furnace has capacity of about 250 to 300 pounds of sponge iron per 24-hour day. Hearth diameter is 43 inches with an 8-inch center hole for discharge of reduced material, tapering to 2½ inches. Four gas burners, supplied through a blower and proportional mixing valve, fire into four 52-inch silicon carbide tubes, each 5¾ inches in outside diameter and located 22 inches above the hearth. Combustion gases discharge into a small auxiliary chamber at the rear of the furnace in which it was originally proposed to crack the reducing gas, but later this was found to be unnecessary.

The hearth may be rotated at three different speeds—one revolution in 45, 75 or 155 seconds. It is completely sealed from outside air by sand seals around the outer lower edge. Outer rim of the hearth, as well as the center core are of refractory, the intermediate portion being filled with small pebbles topped with a layer of fine coke. Reducing gas is introduced into the muffle and reduces the iron oxide in the hot charge as it is rabbled toward the center discharge. A small door in the front of the furnace permits egress of the reducing gas and it burns with a slow, lazy flame while the furnace is in operation, thus sealing air from the muffle and permitting the operator to watch the reduction process and remove "stickers" from the rabble blades.

A rabble arm, of heat-resisting chrome-nickel alloy steel, extends through the sides of the furnace and across the hearth. To it are attached 15 rabble blades of silicon carbide, practically touching the hearth. The blades, eight on one side and seven on the other are set at an angle to keep the charge moving toward the center, being distinguished as cutters and pushers.

Material to be reduced is mixed with a specified quantity of coke (10 to 15 per cent volati
with metallurgical coke or breeze when natural gas is t
ducing agent, and deposited hopper at the right side of t
nace. A belt feed at the base hopper is geared with the speed and feeds the charge screw which conveys it onto t
nace hearth.

In a furnace using semicok as a reducing agent, a weig coke amounting to half the a of iron produced is mixed wi charge. With natural gas use reducing agent, as in this furnace, amount of coke from 5 to 15 per cent of the of the ore charged. The c added to prevent sintering charge.

It is to be noted that metallu coke, anthracite coal or gra carbon will not appreciably iron oxides at the temperatur vailing in low-temperature tion. It requires what may be t an "amorphous carbon," such sults from the low-temperatur bonization of coal, which p should contain 10 to 15 per cen tile matter; or from nascen bon resulting from the deco tion of natural gas; or from t of externally produced carbon

View at charging end of sintering furnaces at Moraine Products division, General Motors Corp. Operator is placing briquetted parts on heat-resisting alloy trays which travel through furnace on mesh belts. Photo courtesy General Electric Co.

ich as water gas or producer
nce, coke breeze is used as a
preventive primarily.
erature in the furnace is con-
hrough a thermocouple and
cating pyrometer. At the
s writer witnessed the opera-
ranged from 1930 to 1970 de-
ahr., with a mill scale finer
mesh being reduced. The
vas being operated at inter-
speed, with reduction ac-
hed in about 15 minutes. Re-
sponge, by chemical analy-
ed 96 per cent iron, 100 per
uced; in other words the re-
4 per cent comprised car-
oke not removed in the mag-
parator, a small amount of
d some manganese existing
riginal mill scale.

Suitable Ore Types

ater run, an East Texas red-
own limonite ore, analyzing
cent iron and ground to 200
was reduced to a sponge
81.8 per cent total iron, 97
t reduced. The latter test
nsidered inferior by Ander-

leads to a consideration of
pe or types of iron ores are
ited to low-temperature re-
At the outset it should be
hat every ore is a "law unto
nd only by dint of repeated
n suitability for reduction be
ned. Of major importance
gangue or silica content of
and its intimacy of associa-
th the iron oxide. In some
or example the silica is in-
y associated with the iron
nd prevents acceptable mag-
paration of the sponge iron
he silica, although the iron
s perfectly reduced; other
n be made more suitable for
eduction by a so-called "mag-
ast" preceded by a scuffing
ing process in tube mills. The
rocess, now under test by the
of mines, in effect works the
ide off the silica gangue,
it free for reduction.
nagnetic roast involves mix-
ore with 3 per cent coal,
with a bare flame at 1300
Fahr. in an air-tight cham-
is treatment reduces ferric
o ferro-ferric or magnetic
which then can be extracted
gnetic separator. The iron
of an ore sometimes can be
rom, say, 50 per cent to 65 or
cent by such roasting.
high-purity sponge such as

demanded for pressed and sintered parts, the magnetite ores or mill scale are the best materials for reduction. Mill scale is first heated to remove accumulated oil, and then ground to proper size for reduction. Hematites and limonites can be processed into an 80 to 85 per cent sponge without magnetic roasting. Titaniferous ores require a higher reduction temperature and the resultant sponge is not suitable for pressing. Pyrites are ideal for reduction after they have been calcined. but sulphur cannot be brought much below 1 per cent—too high for use in steelmaking. However, a chlorodizing roast will convert pyrites into an excellent material for direct reduction. Pyrites are treated with chlorine to form iron chloride and sulphur. The former is dissolved in water to separate from silica, and then oxidized to Fe_2O_3, liberating chlorine which can be used over again.

Phosphorus Not Reduced

Phosphorus, generally present in iron ores in the form of tricalcium phosphate, is not reduced at temperatures used to reduce iron oxide; therefore no alloying or chemical combination of iron and phosphorus occurs. Sponge iron, reduced from high-phosphorus iron ores which have been ground to pass 35 mesh generally will retain about half of the tricalcium phosphate attached mechanically to the iron after magnetic separation. Finer grinding will eliminate more of this phosphate. However, if the sponge is to be used in iron or steel production, this is unnecessary because the tricalcium phosphate is eliminated by slagging during the melt.

Adhering manganese oxide also may be eliminated by slagging. Varying amounts of this oxide will cling to the sponge iron after magnetic separation since manganese oxide is only reduced to manganous oxide at the temperature of iron reduction. Likewise silica is not reduced and will cling with varying degrees of tenacity to the reduced sponge, some elimination being possible by magnetic separation.

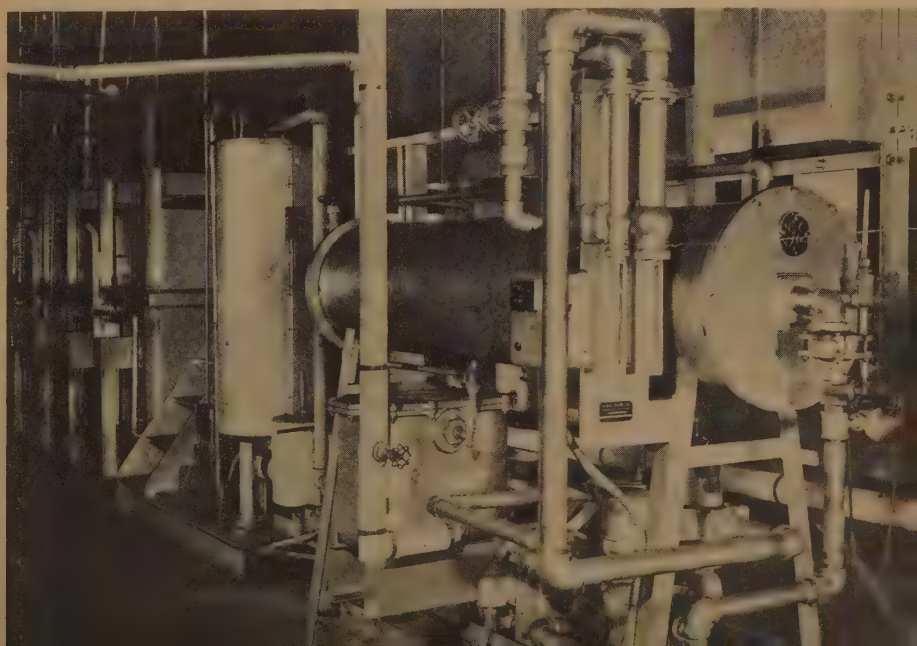
Little Combined Carbon

Carbon does not combine chemically, or at most in minute amounts, with sponge iron during the 10 to 15 minutes in which the iron and reducing agent are in contact in the furnace. A combined carbon content of 0.03 per cent is maximum for a contact of this period. If time in the furnace is increased to 30 minutes, then combined carbon is likely to increase to 0.1 per cent in the sponge. Further, a small amount of semicoke entrapped in the sponge and not removed during magnetic separation, often accompanies the iron.

In the reduction furnace using natural gas, a carbon deposit may be precipitated by nascent carbon in the gas, especially when the furnace is first started or when operating conditions have not been adjusted properly. Some of this carbon can be removed by blowing out with a fan installed in the magnetic separator. Its presence is readily detected by virtue of its blackening effect on the sponge which, under ideal conditions, emerges from the discharge screw uniformly gray in color.

Chromium and vanadium oxides are not reduced at the temperatures used to reduce iron oxides. Chrome iron ore, however, may be charged to the sponge iron furnace with semicoke, and the ferrous oxide present is reduced to metallic iron. The resultant mechanical combination of iron and chromic oxide is magnetic and the magnetic concentrate produced contains a much higher chromic oxide content than possible by present methods of chrome iron ore concentration.

Other metals also may be reduced



stion - type gas generator supplying 2000 cubic feet of hour for sintering furnace in und. At center is refrigerated ler. Photo courtesy General Electric Co.

Mechanical sizing press at Amplex division, Chrylser Corp., for restriking parts after sintering operation. On large-run orders, parts are handled through automatic dial feed. Dies are alloy steel, ground and lapped to the same accuracy as a plug and ring gage

from their metallic oxides in the sponge iron furnace. Anderson has produced successfully the following: Nickel, cobalt, ferrotungsten powder, tungsten, tin, lead, zinc, and copper. Nickel and cobalt are reduced from their ores in exactly the same way as sponge iron is made, with the same equipment. Wolframite concentrate mixed with semicoke may be reduced to a mechanically inseparable combination of sponge iron and sponge tungsten together with whatever manganese oxide occurs with the wolframite. Ferberite concentrate produces a ferrotungsten powder containing less manganese oxide. These ferrotungstens are comparatively free from carbon, it has been found.

Tungsten powder may be reduced from tungstic oxide at 1050 degrees Cent., but the product, if reduced with semicoke, must be separated by oil flotation or gravity concentration; if reduced with gas, the resultant tungsten powder requires no subsequent treatment. Powdered tungsten, reduced by semicoke, is not so pure as that produced by reduction with gas.

Tin oxide is completely reduced in from 10 to 15 minutes at 980 degrees Cent. if the tin concentrate is crushed to pass 35 mesh. Molten tin seeps through the semicoke bed on the hearth and drains to a kettle suspended below the rotary hearth. A low-iron tin concentrate is advisable since selective reduction between tin oxide and iron oxide at this temperature is not possible.

Oxidized lead zinc ores may be reduced selectively, particles of lead coalescing on the hearth and the zinc reduced as vapor and collected either by condensing or burning to zinc oxide.

Speed of Iron Reduction

A vital factor in the cost of sponge iron is the speed of its reduction. In general, Anderson's tests have shown the commercial feasibility of producing 50 to 75 pounds of metallic iron per square foot of hearth area per 24 hours, assuming the charge to be cold, crushed to 30 mesh and comprising either the 50 per cent grade of iron ore or mill scale. This figure also contemplates no preheating of combustion air. If the ore or mill scale is preheated to about 1800 degrees Fahr. before introducing to the reduction hearth, capacity is increased approximately 70 per cent per square foot of hearth area per day.

Degree of Iron Reduction

If the ratio of concentration of CO to CO_2 is 75 to 25 per cent or greater; if the time of reduction and the temperature bear their proper relationship; if there is no leakage of air into the muffle, and if the sponge iron is cooled to atmospheric temperature before it is discharged into the air, then the reduction will be substantially complete—99 per cent or more. It has been noted on numerous occasions that an opening the size of a lead pencil in the sand-seal on the discharge pipe below the furnace hearth will cause reduction to drop from 100 to 90 per cent. Further, if the quantity of water in the water-jacketed discharge mechanism is insufficient to cool the iron to atmospheric temperature then iron particles will show plainly a bluish tinge upon exposure to the air, indicating a slight degree of re-oxidation.

Cost a Prime Issue

In any discussion of sponge iron and its eventual possibilities, the matter of cost is of vital importance. Under present conditions of limited consumption, users of high-purity sponge iron are importing material from Sweden and paying approximately $150 per ton for it. This high-grade sponge is produced by crushing and grinding only the bottom "cakes" reduced in the fireclay crucibles referred to earlier in this article. Upper cakes reduced in these crucibles range from 88 to 94 per cent iron and are reported to be available for $45 to $50 pe[r] solid form.

It seems apparent that a p[ro] market for sponge iron man[y] the size of that existing t[o] awaiting only the producti[on] high-purity domestic spon[ge] which can be sold for aro[und] per ton. In other words, pro[s]pective users are waiting for the [in]dustry to create the market." Cor[re]spondents those active in the developm[ent] sponge iron production r[e]cently state flatly that the "mark[et] create the price"—in other [words] if a guaranteed outlet for [a] sufficient quantity of sponge wa[s] available, then and only then wi[ll] prudent to set up plant and [equip]ment for supplying the iron [at] wished-for price. And it is [also] stated that a plant can be [built] supply a daily requirement [of] tons of sponge iron and [show] profit at a price of $50 per [ton] larger plant might lower [cost] further.

Demand Must Increase

The latter course would ap[pear] this writer to be the logic[al] It is utter folly to erect a p[lant] glut the market with $[50] sponge iron with no assuranc[e] can accommodate the output [of] such a plant would have. [Since] nearly all new developments [of] must be determined by volu[me] output, and as the latter inc[reases] the former decreases.

It might be inferred that e[rection] of a modern sponge iron plant [would] be an ideal project for idle [capital] but idle capital is loath to [move] the direction where profi[ts are] nebulous, and until users' r[equire]ments can be determined m[ore] curately the possibilities of p[rofit] such a venture are vague. As [a] ter of fact, the Fisher inter[ests] one time invested consi[derable] money in a plant for spong[e iron] production in Detroit, bu[t the] project faltered, principall[y] cause a sufficient market f[or] material was not developed, a[nd] because of operating difficult[ies] previously outlined. In fact, [even] this plant with which the la[te] liam H. Smith was connecte[d] it is believed the Ford interes[ts] invested a considerable s[um] money in the venture prior [to] building of this plant.

At the moment, possibiliti[es] pear bright for powdered ir[on] formed sources state a mark[et] several hundred tons daily [if] only on the matter of price [of] raw material. Take the ca[se] brake drums. A brake drum o[f] pressed and sintered iron [will] about 10 pounds. With four [to] car, a unit consumption of 40 [lb.] per car is indicated. Chevrol[et] duction, for example, approxi[mates] 1,000,000 vehicles yearly; thus [the] drum requirements would ca[ll]

ons of iron a year, or about
s daily.
iderson can supply a 96 per
n or better, at a cost of 2 to 4
er pound, or $40 to $80 per
inion around Detroit is he
have no trouble in lining up
business to require anywhere
0 to 500 tons per day, and he
even obtain long-time con-
for such a supply.

Large Volume Possible

ny rate, developments in this
ear watching. The volume
tion of compressed and sin-
ron parts for automobile use
to rest only on a meeting of
of prospective users and sup-
of the powder.
attempt to enumerate and
y possible uses for sponge
ecessarily must be sketchy
complete; but from present
lation, the following listing
ts itself:

- pen-hearth charges.
- upola charges.
- rought iron production.
- lectric furnace charges.
- aterproofing ingredient in
ncrete aggregates.
- on carbonyl production for
soline industry.
- opper precipitation and de-
lphurization of lead-zinc sul-
ides in mining industry.
- roduction of compressed and
ntered parts.

tion already has been made of
e of powdered iron in open-
and cupola charges, and the
lities on this score do not ap-
ny too distinct. In competition
big iron and scrap, powdered
ecessarily must lose out on a
basis, except perhaps in iso-
ocalities.

e merits appear in the use of
red iron for production of
ht iron (3), by mixing the
iron with powdered iron sili-
ag, heating to a welding tem-
re to consolidate the pow-
iron, squeezing to eliminate

**tted, sintered and sized bear-
are impregnated at Amplex
by dipping them for about 15
es in a bath of oil heated to be-
n 225 and 250 degrees Fahr.**

excess slag and rolling in the customary way. Wrought iron made in this way is said to have all the usual qualities of the best hand-puddled wrought iron, and as the product sells at a relatively higher price than steel and cast iron, its commercial production in the above way may offer opportunities.

In the production of alloy steel of high grade, the purity of sponge iron makes it an ideal base or sweetener for electric and crucible furnace charges (4). Already it has been put to some use in the production of tool steel, cutlery, saw steels and steel for valve spring wire. Here again the higher price of the product makes feasible the use of higher cost ingredients.

Powdered sponge iron as a waterproofing ingredient in concrete aggregate (5) is another special outlet. It is expected a considerable demand eventually may develop for use of this iron in concrete highway construction in climates subject to alternate freezing and thawing and therefore to cracking and spalling. Iron powdered by grinding turnings in a ball mill is now used in a small way for waterproofing purposes, but is too costly to be used as an ingredient in concrete aggregate and cannot hope to compete with sponge iron for this purpose.

Makes Antiknock Gasoline

Experiments have been made in the application of iron powder for preparation of iron carbonyl, $Fe(CO)_5$, which has been demonstrated to be a suitable fluid for imparting antiknock properties to gasoline. The carbonyl is produced by passing pure carbon monoxide over powdered iron at 350 degrees Fahr., forming a mist which is condensed. It weighs about 12 pounds to the gallon and has been marketed for around $8 per gallon. Iron carbonyl also has been used to some extent in the removal of sulphur from oil and gas. From a tonnage standpoint, the requirements for sponge iron would appear limited[1].

Already mentioned has been the use of sponge iron for copper precipitation, an outlet which has shrunk since copper ores have become mostly of the sulphide type rather than oxide. Production of sponge iron for the desulphurization of mixed lead-zinc sulphides (7), obtained as a "bulk" flotation concentrate from complex lead-zinc ores, has been reported. Metallic lead and metallic zinc may be produced directly from the concentrate by treatment in a special design of high-frequency induction furnace, a process which necessitates low-cost electric power since it requires about 2000 kilowatt-hours per ton of zinc and 300 kilowatt-hours per ton of lead produced. Metallic antimony may be produced by direct desulphurization by powdered iron in a similar way.

As intimated previously, by far the greatest potentialities for sponge iron loom in the field of compressed and sintered parts (8), an outlet of which obviously only the surface has been scratched.

Those active in the manufacture of parts in this way are extremely reticent to divulge any complete details of the process, but a few essentials have been learned. In the first place, a sponge iron of 96 per cent purity or better is required. Users would like to have a 99.9 per cent material, but in most cases must be satisfied with something below this figure. The material usually must be of a size to pass 250 mesh. First step is to introduce the powder through a hopper into the dies of a briquetting press where the shape of the part is formed under a pressure of about 40,000 pounds per square inch. Allowance for subsequent sizing is about 3 per cent. Dies in the briquetting press are of special alloy steel, hardened, ground and lapped, and will withstand about 25,000 impressions be-

[1]Later communication from Anderson states that he has been investigating more thoroughly the production of pure iron powders from sponge iron, and the production and decomposition of iron carbonyl. He has found by test that sponge iron produced in his rotary hearth furnace will be dissolved entirely as iron carbonyl [$Fe + 5\ CO \longrightarrow Fe(CO)_5$] and thereafter will be broken down easily to carbon monoxide and pure iron—99.8 per cent Fe. He notes further that "it is now a question of costs, although it appears that, eventually upon a large scale, this kind of iron can be made relatively inexpensively."

Physical Tests of Compressed, Sintered and Sized Bars Made from Three Different Types of Sponge Iron

Bar No.	Weight, grams	Thickness, inches: Slack (est.)	Thickness, inches: After cold press	Thickness, inches: After hot press	Size of reduced section, inches	Rockwell B hardness	Olsen load, pounds	Tensile strength pounds per square inch	Elongation, per cent
					DOMESTIC IRON A				
1	50 (0.5 Cu)	0.532	0.174	0.111	0.110 x 0.365	..	.....	.....	..
2	50 (0.5 C)	0.532	0.172	0.116	0.110 x 0.365	72	998	23,950	2
3-4-5	50	0.532	0.171	0.108	.....	..	1,048	43,550	2
6	25	0.266	0.083	0.061	(Bend test)				
7	15	0.159	0.052	0.040	(Bend test, no ductility)				
8	88	0.946	0.295	0.186	0.175 x 0.365	..	2,331	36,400	3
9	88 (1.0 Cu)	0.946	0.295	0.183	0.175 x 0.365	..	2,226	34,000	3
					SWEDISH IRON				
1	50 (0.5 Cu)	0.266	0.150	0.104	0.110 x 0.365	82	2,405	63,600	10
2	50 (0.5C)	0.266	0.157	0.078	(Broken in handling before sintering)				
3-4-5	50	0.266	0.148	0.105	0.110 x 0.365	..	1,750	68,300	12
6	25	0.133	0.075	0.060	0.047 x 0.615		(Young's modulus		24,393,000)
7	15	0.078	0.047	0.036	(Bend test, fair ductility)				
8	88	0.465	0.263	0.166	0.175 x 0.365	60	2,961	48,200	9
9	88 (1.0 Cu)	0.463	0.267	0.178	0.175 x 0.365	82	3,978	62 600	8
					DOMESTIC IRON B				
1	50	.....	0.157	0.097	0.110 x 0.365	..	1,712	65,300	11
2	25	.....	0.083	0.055	0.047 x 0.615		(Young's modulus		24,029,001)
3	15	.....	0.047	0.033	(Bend test, fair)				

fore requiring regrinding for a larger size.

From the briquetting press the parts are transferred to a sintering furnace where they are subjected to a temperature in the range 1850-2050 degrees Fahr. Exact temperature is dependent upon the type of part and the briquetting pressure. High pressures mean lower temperatures, and vice versa. The maximum sintering temperature usable is about 2050 degrees, since above this point, distortion is apt to be encountered. Time in the furnace is not excessive, 15 minutes being average—10 minutes for bringing to temperature, and 5 minutes holding at temperature.

Needs Reducing Atmosphere

A reducing atmosphere must be maintained in the furnace to avoid oxidation. Both gas-fired and electric furnaces have been designed for the work, the electric units being practically duplicates of those used for copper brazing operations. Parts usually are handled on heat-resisting alloy trays, although a wire mesh belt can be used if the parts are not overly heavy and the furnace length does not exceed about 8 feet. Using an electric furnace 22 feet in length, with a roller hearth, net production is 2500 pounds per hour.

In the cooling and restriking or sizing of sintered iron parts there are two schools of thought prevalent; one believing that restriking should be done while the parts are fairly hot, in order to reduce pressures required, the other preferring to cool the pieces in the furnace to below 1000 degrees Fahr. and then to transfer them to the sizing press. If oxidation is objectionable and tolerances are small, the latter technique is preferable. Pressures in the sizing operations approximate one-third of those used in briquetting—one plant using straight-sided punch presses for restriking to size.

The sizing operation, in reality, appears to be the secret of obtaining a good part, with satisfactory strength and other physical properties. For example, after briquetting, the sponge iron will show a specific gravity of about 5; restriking hot increases this to approximately 7.

After sizing, the parts may be ground to length if required, or in some cases completely surface ground. For bearings and bushings, however, inside and outside diameters are held to tolerance in the sizing operation. Thereupon, the parts are dumped into a tank of oil where they become completely impregnated with lubricant which can be wiped off the outer surface before shipment.

Data are meager on the structural strength of this material, but from one source it is learned that compressed and sintered bushings and bearings of iron powder have been produced to withstand a bearing load of 50,000 pounds per square inch under zero velocity. This figure compares with several hundred pounds per square inch exhibited by conventional types of nonferrous bearings and bushings.

An accompanying table gives the results of physical tests on compressed, sintered and sized bars of three different types of sponge iron. Tensile strengths ranging from 23,950 to 68,300, elongations from 2 to 12 per cent and Olsen loads from 998 to 3978 pounds will be noted. These tests should not be con typical of commercial practic they were made on parts pr experimentally and exhibit range of values. But they do indication of what can be a lished with pieces made of th terial.

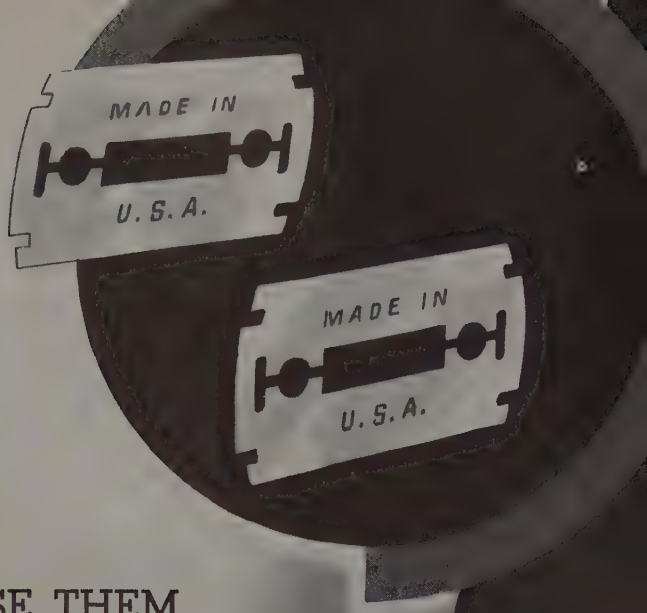
Conclusion

In concluding this extens view of the production, proc and use of powdered spong it might be pointed out that literature abounds with schen production of iron by low-te ture reduction, most of the brain children of enthusiast in flights of fancy, see their p putting the blast furnace business and enriching the pa by untold millions. At this po first obstacle intervenes—lac plant to demonstrate the p Thereafter, whatever sponge produced is made either in an crucible or merely by conver

There is nothing inherent in low-temperature reductio the attempt to clothe an anci heritance in modern dress ha tivated the attention of many, whom—in the United States, a —as yet have failed to mak perceptible dent in commerci ceptance of their material.

But the development is means dead, or even dying. metallurgists see in the prod of sponge iron by low-tempe reduction on a commercial sca next great step forward in science. Certainly the found are being placed for a vast n dustry. How fast it matures to what extent, are secrets shr in the mantle of the future.

They Look alike



BUT THE DIFFERENCE

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84-Inch Cold Mill

Finishing department of new mill includes 80-inch continuous pickler handling strip at 240 feet per minute. A reversing mill, 5-stand tandem mill and a 3-stand tandem mill are available, latter unit delivers 77-inch strip at 912 feet per minute

■ IN ADDITION to the 80-inch, continuous, hot-strip mill and the cold reduced, tin-plate mill at Carnegie-Illinois Steel Corp.'s new Irvin works near Pittsburgh, complete facilities have been installed for cold reduction and finishing of strip and sheet ¼-inch thick and lighter, up to 77 inches in width, in coils up to 54 inches outside diameter and 20 inches center, or in sheets up to 32 feet in length.

Hot-rolled coils for cold reduction are taken by a 20-ton crane or by ram type tractors from the coil storage room to the entry end of an 80-inch continuous pickling line. This line handles strip from 28 to 77 inches in width and has an estimated capacity of 230,000 gross tons per year. At the uncoiler, strip is bent sharply over a small diameter roller as it leaves the coil to prepare the surface for rapid clean pickling and to eliminate the possibility of coil breaks occurring. It feeds forward through an upcut shear to an electric seam welder, or if desired to a stitcher where coil ends are joined for continuous pickling.

Pinch rolls take strip through the wash pit at 240 feet per minute; then strip passes through four rubber-lined, brick-faced acid tanks, a cold and hot rinse and out to the dryer. Looper pits at both ends of the pickling line permit cor strip movement through while welds or stitches ar made or cut out. An upcu at exit end removes w stitches. Coils move on a scale to a trough type gra conveyor which takes them age. From conveyor dischar they are moved to storage o cold reduction mills by trac

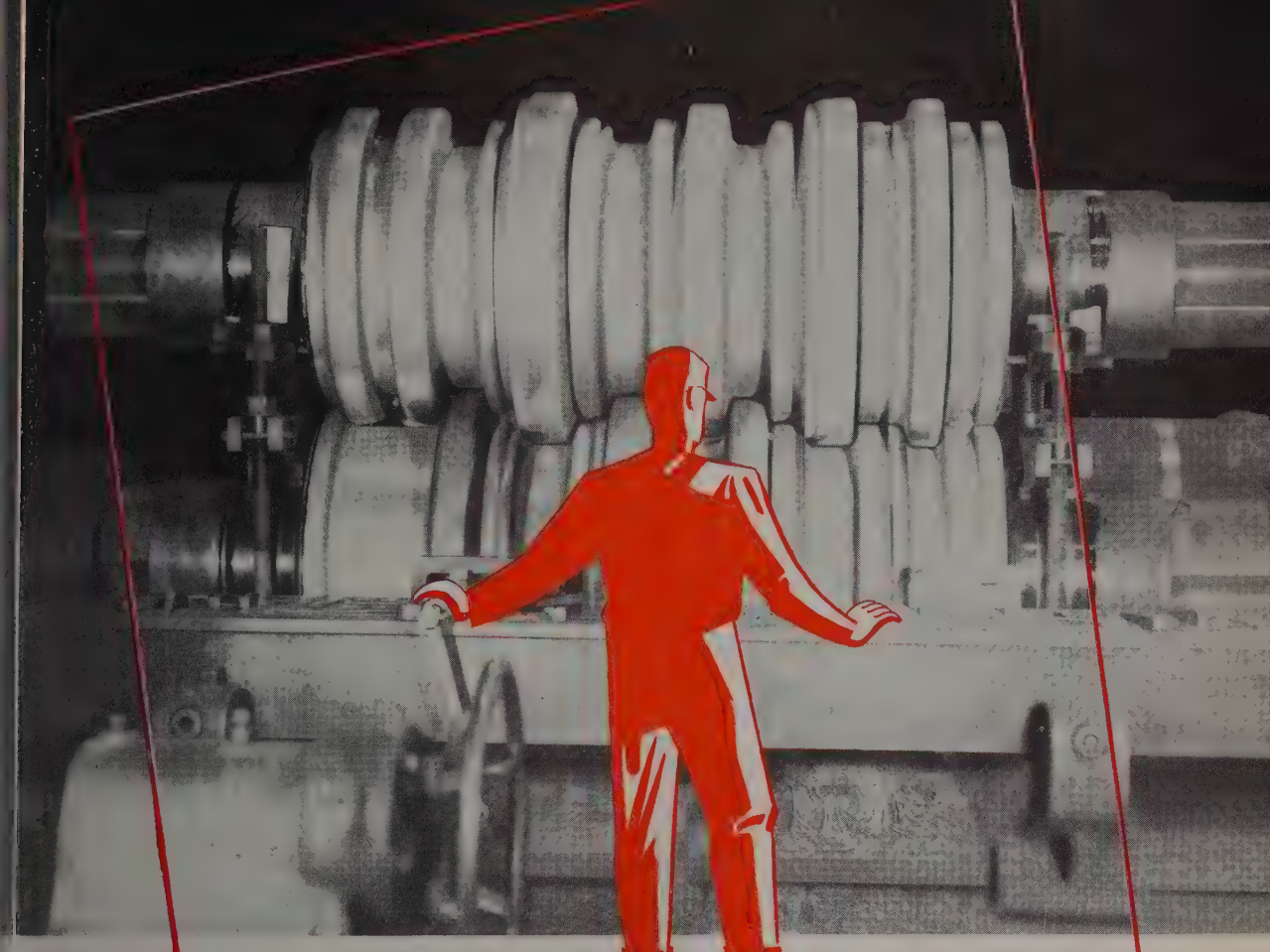
All metal parts in the line exposed to acid or fur protected and connected wit haust system to avoid st fumes. Rubber tank lining tected against abrasion by sisting brick. Indicating cording instruments keep t temperatures and strip spee a constant watch is maintain strength of acid solutions.

In the cold-reduction depa three cold mills are availabl 5-stand tandem, 4 high, 20½ x 42-inch mill is used prima cold reducing strip for tin Other material may be cold in either a 20½ and 53 x 54- versing mill or a 3-stand tan high, 20½ and 56 x 84-inch m will handle the new high steels such as USS Cor-Ten Ten and stainless steel. This ment is heavily powered ar fitted for high speed, heav operation.

Reversing mill reduces 0.1 strip to 0.030-inch, or 0.065-in terial to 0.010-inch in three The reels at each end of th will handle coils of 30 inches diameter and up to 54 inch side diameter, taking the through roller levelers. Ea is driven by a 1750 horsepow

STEEL has carried other technical descriptions of the Irvin works as follows: Continuous 80-inch hot mill, Jan. 16, p 56; coil conveyors, Feb. 13, p 69; piping, Feb. 27, p 36; truck-battery charging setup, Jan. 30, p 62

This is a general view of the reversing mill in the cold mill ment of the new Irwin wor



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Hardness . . . 50 to 60 scl. (C. scale)

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Hytensite has no "notch effect,"—so small radii on the neck fillets and various passes do not weaken the rolls. They are used in the intermediate stands of light duty blooming and roughing mills, structural and merchant mills, and in the roughing stands of sheet, bar and billet mills, replacing the "high carbon alloy" rolls of the trade.

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to 600-volt motor, operating at 525 revolutions per minute. The mill is driven by a 3500 horsepower, 600 volt, direct-current motor operating at 150 to 300 revolutions per minute, strip speeds ranging from 500 to 1107 feet per minute.

Wide strip is cold reduced in the 3-stand tandem, 4 high, 20½ and 56 x 84-inch mill. No. 1 stand is driven by a 2500 horsepower, 600 volt, direct-current motor operating at 225 to 450 revolutions per minute. Delivery speeds from this stand may vary from 276 to 553 feet per minute. The No. 2 stand is driven by a 3500-horsepower motor, 150 to 300 revolutions per minute. Strip speed varies from 338 to 676 feet per minute. No. 3 stand has a 2500-horsepower motor operating at 225 to 450 revolutions per minute and delivers strip at speeds between 456 and 912 feet per minute.

Use Flying Micrometers

Cold-reduced coils have an inside diameter of 30 inches and a maximum outside diameter of 54 inches. Flying micrometers maintain a constant, accurate check on strip thickness, and pressure gages are built into the mill stands so the operators may analyze rolling conditions readily.

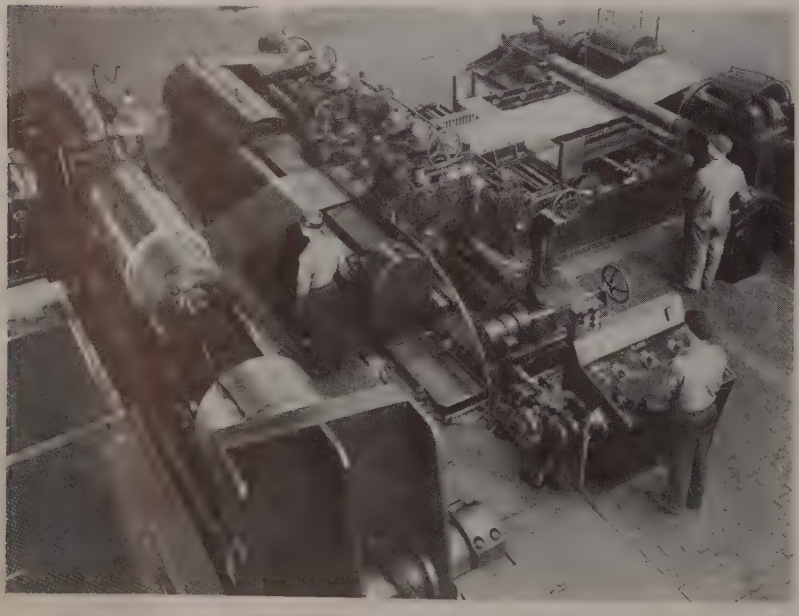
Work rolls on both the reversing and 3-stand tandem cold mills are equipped with grease lubricated, tapered roller bearings. Backup-roll necks have tapered necks, removable sleeves, oil flood-lubricated bearings thrust being taken by an integral flange on the sleeve against two stationary shoes in the chocks. Backup rolls are hydraulically balanced, roll changes being effected with a C-hook. Work rolls are changed by means of a counterweighted rig. Provision is made to furnish both roll and strip coolants. Flying micrometers keep accurate check on the thickness of the strip being reduced. Separate circulating-oil systems are installed for each of the cold-reduction mills as well as for the temper-pass mills.

Power for the 54-inch reversing mill is furnished by two, 4000 kilowatt, motor-generator sets. A 7000 kilowatt, motor-generator set supplies the power required by the 3-stand tandem, 20½ and 56 x 84-inch cold reduction mill. This equipment, together with a 5000 kilowatt, motor-generator set for the 5-stand cold mill used for strip for the tin mill, is installed in a special room adjacent to the cold-reduction department.

These motor-generator sets are 6600-volt alternating-current to 600-volt direct-current units with a 95 per cent power factor. Down-draft circulation provided at the motor-generator sets discharges air into a nonrecirculating cooling system of 225,000 cubic feet per minute capacity. Cooled air then passes up through mill motors into the mill.

Controls co-ordinate individual drives, afford multiple speeds and emergency stops, and show roll-pressure balance, motor loads, strip speed, bus and booster voltages, entry and delivery gage or tension of strip.

Special provision is made for roll and bearing maintenance and storage. A 60-ton crane with a 15-ton auxiliary covers the roll shop and a 10-ton crane is installed over the machine shop. Both have 60-foot spans. A transfer line runs to the 5-stand cold mill and another connects with the 3-stand mill for moving complete roll assemblies easily.



Recoiler unit in cold mill depar

Then after leaving the rollin
cold-reduced strip may eithe
and recoiled in a line cap
handling strip from 18 to 77
wide, 16 gage or lighter, at
between 150 and 450 feet p
ute, or pass any of three s
lines. These shear lines wil
strip from 18 to 77 inches w
gage or lighter, at strip
ranging from 150 to 450 f
minute. Drum type shears
may be set to cut in increm
⅛ of an inch, cut the str
sheets ranging from 30
inches in length. Uncoiler
of these lines is equipped
feeding motor. Side-trimming
have reciprocating type scr
ters to increase blade life
avoid delays in the lines.

Coils are annealed in tw
naces, each with three sets
manent bases and welded
steel hoods or inner covers
vide for controlled-atmosph
nealing. Eight coils, 54 inch
side diameter and 77 inche
may be annealed at a time.

Pack Furnaces

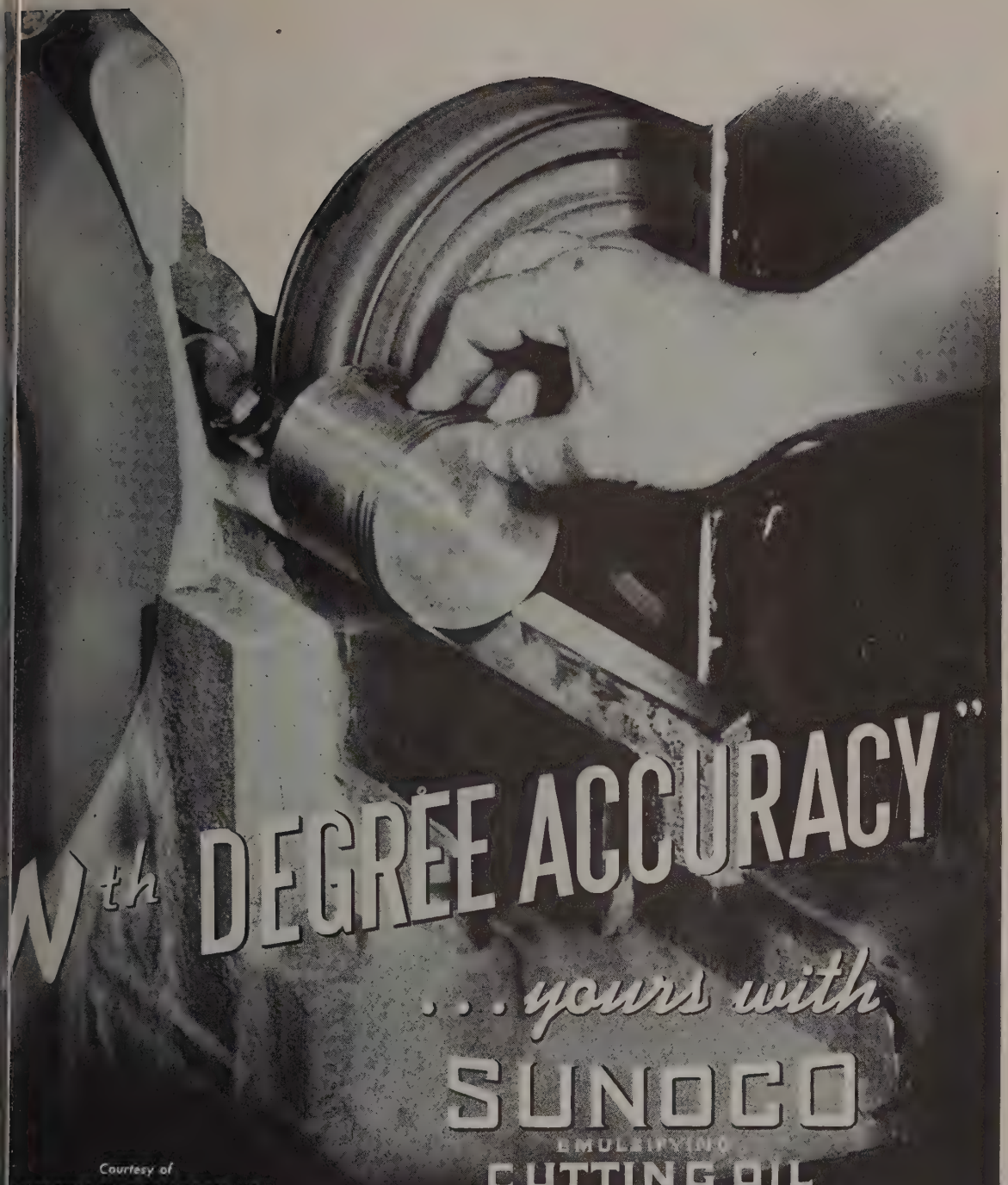
Cut sheet is annealed i
other groups of furnaces s
designed for handling packs
group consists of 16 heating
and 56 permanent bases, 96
inches, with inner hoods f
trolled-atmosphere annealing
40-ton cranes with 15-ton aux
120-fot span, cover the sheet-
ing department.

Sixteen of the annealing
heating covers have horizon
shaped, tubular heating el
using premixed gas from thr
trally located gas mixing s
at 32-ounce pressure. Test-
gases from furnace vents a
toxic. The high velocity, sof
in the large diameter tubes
lishes its own gas recirculati
tem. No exhaust fans are
sary.

Floating temperature con
provided. At beginning
cycle, control is maintained
side-wall couple. When the
wall temperature has been r
control is switched to a top
in the pack, a limit control
maintained through a wall
to avoid overheating. Other
in the pack permit check o
formity of heating.

The other 16 annealing fu
used for either sheet or coile
have vertical heating elemen
spark plug in each tube elim
possibility of unburned gases
tomatic control assures u
heating and annealing on a
termined cycle.

Annealed strip in coil for



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be tempered in either of two 4 high 20½ and 48 x 84-inch temper mills, each handling 16 to 22-gage material, 18 to 77 inches in width or sheets up to 20 feet in length. Coiled strip can be handled at 200 to 450 feet per minute and sheets at from 150 to 450 feet per minute. A third mill of the same type is available for cut sheet alone. This handles 14 to 22-gage sheets, 18 to 77 inches wide in lengths up to 20 feet.

A fourth temper pass mill, 32 x 84 inches, is available to handle either coils or sheet, 14 to 22 gage, 18 to 77 inches wide, in coils up to 54 inches outside diameter or sheets up to 20 feet in length. Piler at this mill is preceded by a 4-high roller leveler instead of a 2-high leveler as used at other three temper mills.

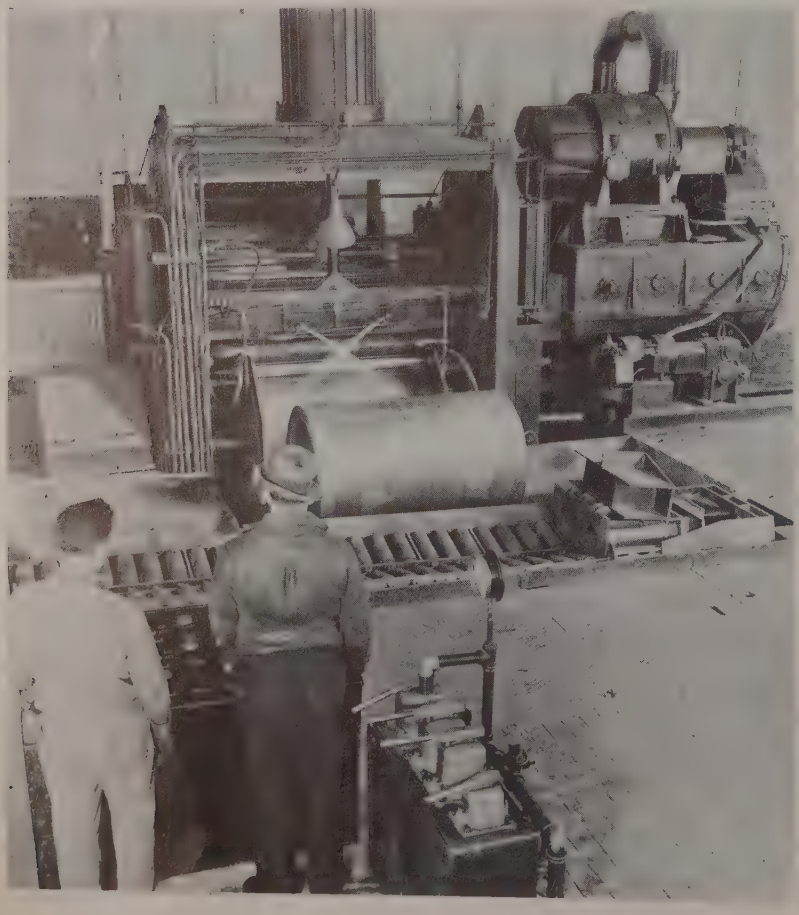
Coils from temper mills may be cut into finished sheets in a special shearing line. A cone type motor driven uncoiler delivers the strip through a 15-roll, 2-high roller leveler to a new type, reciprocating flying shear. This shear will cut material ⅛-inch thick or lighter into lengths ranging from 30 to 180 inches. Knives are synchronized with strip speed which ranges from 130 to 400 feet per minute.

Cut stock from the temper mills usually passes through a side and end trimming line, including a 4-high roller leveler, before going to the warehouse. Additional squaring shears, roller levelers and oiling machines are available in the shipping department. Two 15-ton cranes, 120-foot span, serve truck and car loading platforms.

Close Co-ordination

The cold reduction division of Irvin works is closely co-ordinated with both the continuous hot mill and the finishing equipment. A visitor is immediately impressed with the layout and with the care exercised to maintain a high standard of quality in the product at all times. Every precaution has been taken to safeguard the equipment and to make working conditions pleasant as well as safe. Ample working space is provided around the equipment. Wide aisles assure prompt, safe, and efficient handling of material. Lighting and ventilation were carefully studied. As a result, exceptionally satisfactory working conditions exist throughout the entire plant.

Entry end of 80-inch continuous pickling line showing processing uncoiler



Proceedings of Enar Institute Forum Iss

■ *Proceedings* of the third forum of the Porcelain Ena stitute at the University of Urbana, Ill., Oct. 12-14, 193 been issued in paper-boun form by the institute. Th page book contains a c record of the papers present verbatim reports of discussio subject matter covers a wide of current problems in ena shop practice, laboratory and the use of iron and st enameling stock.

Copies are available at $ from the institute, 612 North gan avenue, Chicago. Upon copies of *Proceedings* of t and second annual forums included without charge with for the present volume. Ad copies of the first and seco *ceedings* can be supplied cents and $1, respectively.

Bureau Studies Elas Properties of Cast I

■ An optical method for me deflection of cast iron tra test bars up to breaking s has been developed by the lurgy division of national bu standards, Washington. De is determined by measuring d between a reference point rubber band mounted on t bar.

Three types of cast iron ha investigated. These were he maximum temperatures of 2732, 2912 and 3092 degrees Test bars 1.2 inches in di were cast vertically, bottom in green sand molds at 18 360 and 450 degrees Fahr. ab liquidus temperature. Tra properties were determined terrupted loading and by loading up to the breaking

From the data obtained th plastic and elastic deflections, lus of rupture, relative mod elasticity, total, plastic and resilience were determined test bars investigated. In g lowest and highest elastic pro were observed for the ma heating temperatures of 25 3092 degrees Fahr., respe These properties tended to d with the increase of pourin perature.

In an examination of the structure of the test bars, co tively fine graphite particles discovered. A laminated, p like structure and the prese large graphite particles sub into hexagonal grains were ob on some unetched specimens

asting PRECISION

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oundry Co. ..... Detroit, Mich.
l Foundry & Mfg. Company ..... Flint, Mich.
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Valley Iron Works ..... St. Paul, Minn.
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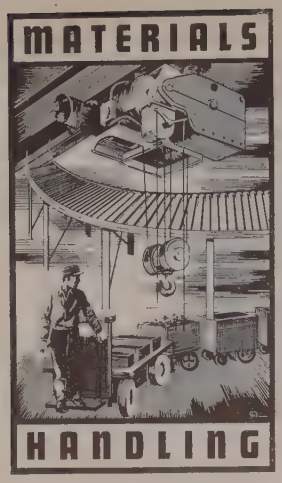
The International Meehanite Metal Co., Ltd. ..... London
Meehanite Metal Corporation ..... Pittsburgh, Pa.



Electric Motor Cores

Unique system efficiently handles 26,000 pieces per hour, the output of one machine. Operator needs only to unload stacked disks, requiring minimum amount of labor. Entire setup synchronized with press for automatic operation

Part I

AT THE SMALL-MOTOR plant of Westinghouse Electric & Mfg. Co., Lima, O., a wide variety of electric motors are made in fractional-horsepower sizes for use on washing machines, vacuum cleaners, electric fans, electric refrigerators and similar items. Since all of this manufacture is of the high production type, all operations necessarily have been arranged on a high production basis.

Stamping rotor and stator core laminations for these motors is one of the most important parts of the manufacturing operations and much thought has been given to arranging equipment and operations for maximum efficiency.

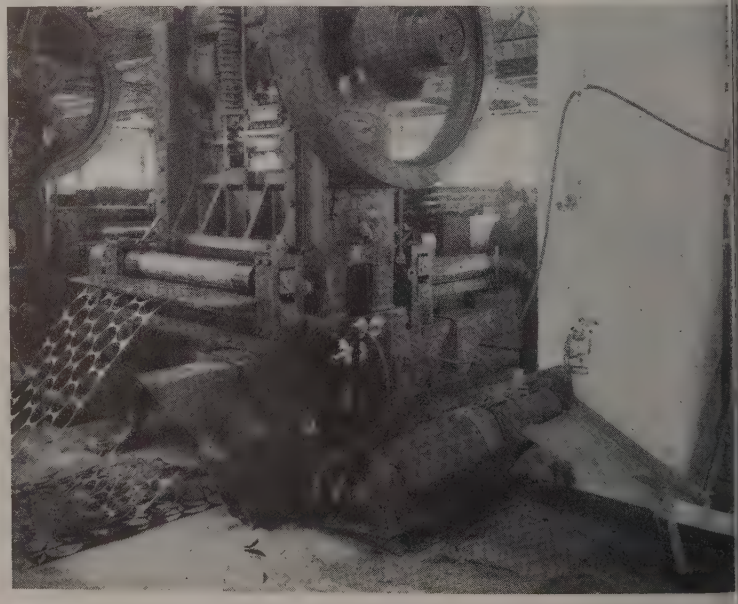
Core laminations 3 inches in diameter and smaller are made from coils of strip, which are fed into an automatic press with progressive dies, some of which produce as many as 4000 pieces per hour. This strip is usually 0.017 or 0.025-inch thick. A typical item produced on these small, high speed presses are the laminations for motors which are being used in electric razors. Fig. 1 is a view of narrow strip going through one of these presses which is making laminations for small electric razor motors. Some of the completed laminations are being held by the operator in this picture.

The core laminations, 3½ inches and larger, start from large sheets. No matter what the size of the core laminations may be, they are from a sheet 33 inches wide. sheets are either 0.017 o inch thick. They are first what is called a cookie press in Fig. 2. As will be no cookies or disks, which will punched to form core lami are stamped out from the s ing dies and feeds so arrang form a continuous skelet disks just clearing each oth this manner the maximum of the sheet is used and m skeleton material is discard

Dies for the cookie press ranged to punch various n of cookies per stroke accor the size of the cookie disk

Fig. 1—Small, high speed press uses steel strip. Small motor rotor laminations stamped out are force fed through bottom of press up through skeleton tube delivery duct just below operator's right hand

Fig. 2—Side view of large cook with automatic feeds. Disks or " fall through press onto belt c system synchronized with p



ed. In some of the larger only five disks are blanked roke of the press. In other seven or nine may be formed stroke. After each stroke, ed mechanism indexes autolly to place the sheet in the t position for the next stroke press. Feed is thus autoonce the sheet has been d by the feed rolls. Feed re installed at both the en- and exit side of the press. vill be seen in Fig. 2 the disks d from the sheet fall through ress onto a belt conveyor extends underneath the press. onveyor is in a number of sec- the first lifting the disks from the press out to one side they are dumped into a chute g a second belt conveyor, also in Fig. 2. These conveyors f the slat type with slats ed crosswise the belt at inter- he disks being lifted by these as the belt moves upward.

Automatic Stacking

eral rather unique features are orated at the delivery end of onveyor. In Fig. 3 is shown tomatic mechanism at the end e of these conveyors where sks are stacked automatically. is another time-saving feature has been found of great merit orward step in complete mechion of all handling processes. ookie disks come up the con- at a great rate since the cookie punching six pieces, 6 inches ameter at one stroke or an alent number of smaller pieces, tes at about 72 strokes per te. This is 4320 strokes per which means that 25,920 disks elivered at the end of this con- each hour.

ting and stacking this quantity l be a tedious operation if done nd. Thus the automatic stacktup is of great value. A close- this mechanism, seen from the n Fig. 3, will be found in Fig. isks are dumped into a chute p of the conveyor, this chute shaped to form a spout as e seen clearly in Fig. 4. The delivers disks on edge to a of rapidly revolving shafts are threaded to carry the to the right in Fig. 4. These shafts are revolved by a small motor seen at the left in this view. The disks delivered at the right of the screws form themselves automatically into a stack. A spring-loaded end weight maintains the stack on edge while it grows larger.

With this equipment the operator simply picks up the completed stack as it grows and places it on the truck skid as shown in Fig. 3. These

(*Please turn to Page* 84)

. (Top)—Delivery end of the consystem from the cookie press. network of tramrails covering e areas in back. Fig. 4. (Center) eup of the automatic stacking ma- at discharge end of the con- in Fig. 3. Fig. 5. (Bottom)—Other es in press shop. Parts are hanled in large steel tote boxes

Get this Point!

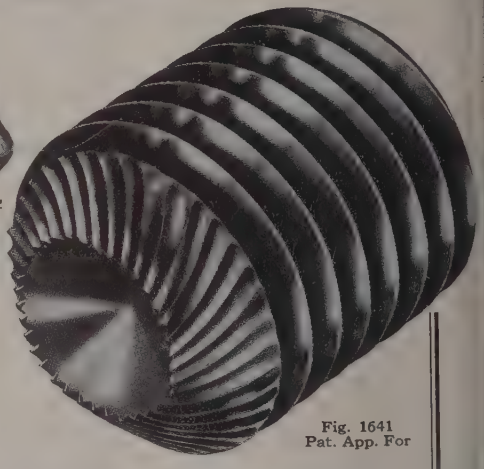


Fig. 1641
Pat. App. For

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Fig. 1645
Pat. App. For

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Fig. 16
Pat. App.

Large Pot Chuck

dvances in heavy machine tool equipment re evident in unusual circular chuck of elded structural steel. It is part of a machine ool which accurately cuts gears to rotate battleship turrets

ENTLY Camden Forge Co., n, N. J., purchased a welded ot chuck, 33 feet 7 inches in diameter, 3½ feet high, ng 96,200 pounds. It will be slotting the teeth of forged l gears which rotate the tur- upporting a group of three guns on battleships. Pos- the largest pot chuck ever t was designed and fabricated ikenweld, Inc., division of s Steel Co., Coatesville, Pa., aboration with the engineers den Forge Co.

gn, fabrication, transportation stallation of the pot chuck d some unusual and difficult ns. Because of the accuracy d in slotting turret, ring-gear rigidity was of primary im- ce. Preliminary design for the was based on production in on. While one-piece construc- as preferable, in redesigning elding, it could not be em- because of the impossibility ping such a large structure. eared most practical to use gn comprised of two half sec- and two loose central spokes, ted separately and shipped to n for the welding together sections.

Box Sections Employed

provide added torsional rig- box sections were employed. of the 12 spokes consists of annel members, formed on a brake from steel plate, ⅝-inch The two channel members of each spoke then were butted together on their edges and welded on both sides along their full length of 13 feet 2 inches to form a box 10 inches wide, tapering from a height of 17 inches at the hub down to 8½ inches at the circumference of the ring to provide clearance.

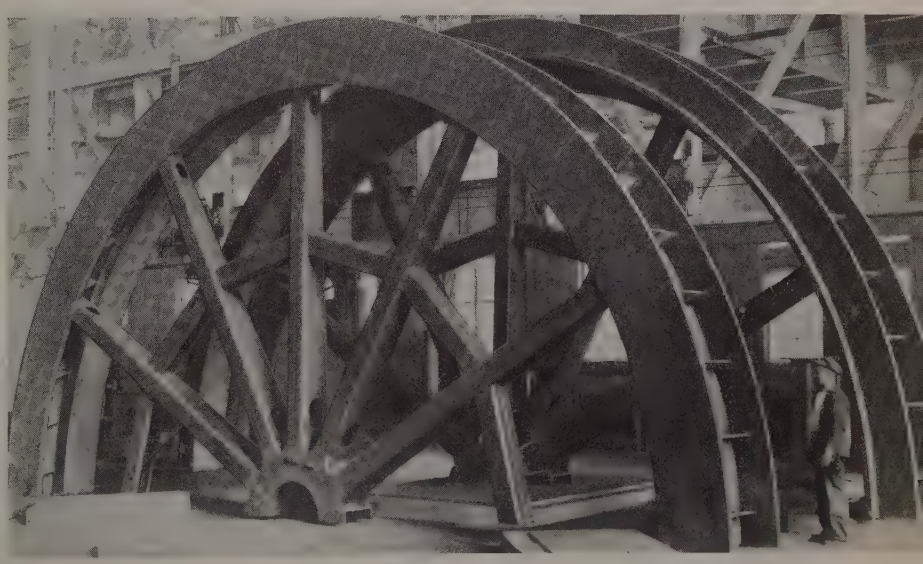
Spokes Internally Welded

To permit internal welding, elliptical openings were flame cut in the sides of the spokes. At the circumferential end of each spoke and from the main web of the pot chuck, sections were removed by flame cutting to bring each spoke through the main web and permit the use of a full strength joint in welding the spokes to the main web. If spokes were welded to inside of the main web, it would have been necessary to make all of the welds internally in confined space at those points and through small access holes cut in the spokes. Obviously, such welds would lack the efficiency of the full strength joints deemed necessary and obtained with the design used.

Twelve segmental spacers fitting between the spokes also were formed in one piece from steel plate ½-inch thick on a press brake. Each spacer is a three-quarter box section with one side open but with the edges flanged down to a depth of 2 inches. Spacers were 10 inches, wide, 10 inches high and approximately 4 feet 4 inches in length. Ends were trimmed by flame cutting at the angles required to fit between the radial spokes.

Forming a transition member, central hub section rigidly ties ends of radial spokes into center or innermost ring, which was formed in halves. The two pieces of the in-

(*Please turn to Page* 83)



two half circles form a welded ot chuck, 33 feet 7 inches in diam- ad weighing 96,200 pounds. After nt, pieces were assembled by g together the two halves and ose spokes to make the com- plete unit

Auto Headlamps

Torpedo type headlight shells are produced by deep drawing flat sheets in a highly efficient stamping and forming setup. A series of steps first is formed. Then these are smoothed out in hydraulic press after approximate shape has been attained

INTERESTING manufacturing operations connected with the production of lamps for automobiles are found at Anderson, Ind., in the plant of Guide Lamp division of General Motors Corp. Here a wide variety of head lamps, tail lamps, parking lamps and license plate illuminators are made.

The ultra-streamlined torpedo-shaped headlamps featured on numerous models of Pontiac and other General Motors' cars are stamped and formed from flat sheets to the torpedo shaped contour. This is done in a number of successive drawing operations which finally result in a total depth of draw of about 12 inches with diameter of the shell being reduced from 18 to about 8 inches during drawing.

Details of these operations follow: First operation is to blank the disks subsequently formed. These are 17⅛-inch diameter circles. These blanks come to the first forming press in wooden, steel-lined boxes. Operator removes a blank from the box and places it in the press for the first operation. The flat disk is made into a large cup and diameter is reduced about 40 per cent. From 17⅜ inches the diameter is now 9¾ inches inside the cup which is 6 inches deep. There is about a 1-inch flange or lip around the outside edge of the cup as B in Fig. 1.

As the top die of this press rises from the work erator has already gripped blank ready to place it in and he hooks the edge of t under the formed piece, out of the bottom die and it back out of the press falls in a chute leading t erator's position at the seco

Consecutive Formin

Operator at the second p up the piece from the chu it in his machine where is given the second draw. operation the cup is given form as the diameter is r 8 inches and depth increas inches as shown at C, Fig erator here follows same as first operator; that is, af ing he removes the work press by hooking a new pi the lip and raising the w the lower die. This is foll pushing the formed piece the press into a chute at which delivers the work a where the third operator c reach it. The arranger presses which makes this is diagrammed in Fig. 2. I noted that working side press is alternately at right of the line.

In the third press, the ceives a forming operatio places a step on the side double cup. This step is inches long and 6¼ inches

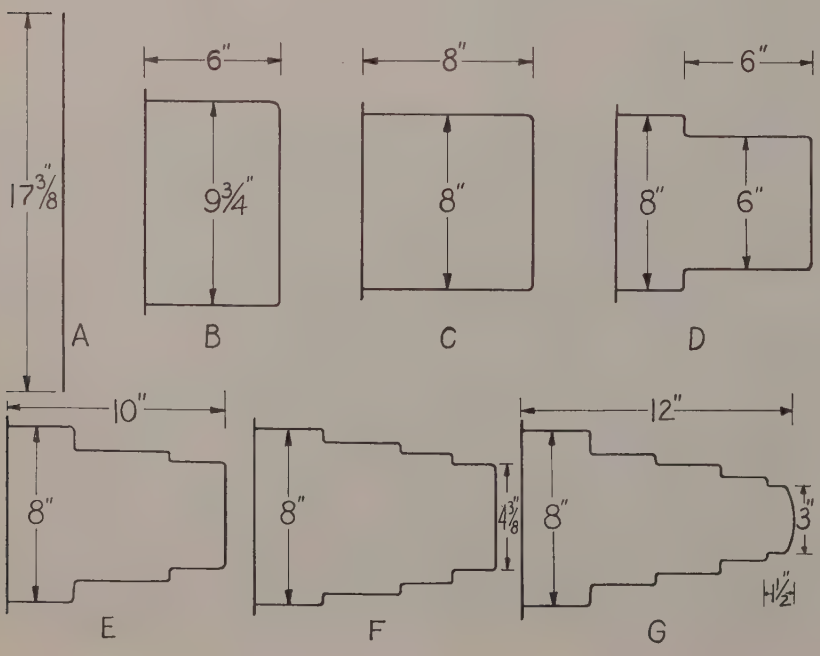


Fig. 1—Various stages in produ streamlined torpedo shaped h shell. Not to scale

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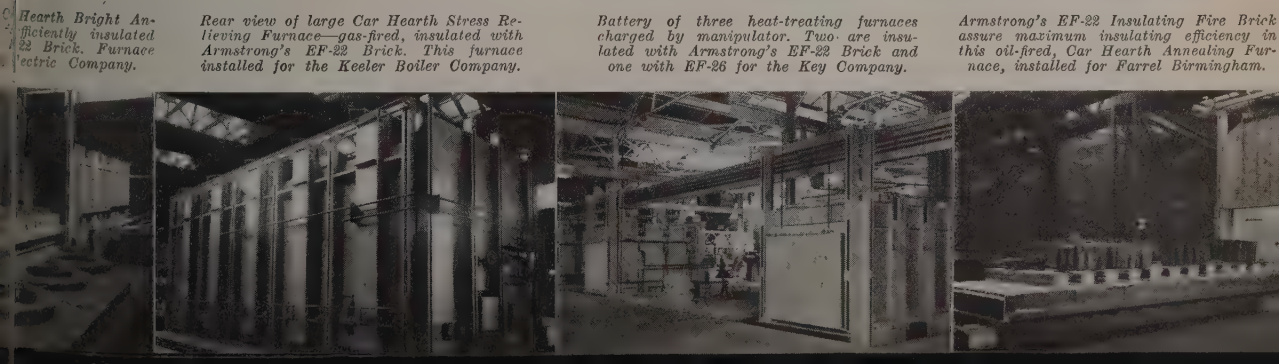
Rear view of large Car Hearth Stress Relieving Furnace—gas-fired, insulated with Armstrong's EF-22 Brick. This furnace installed for the Keeler Boiler Company.

Battery of three heat-treating furnaces charged by manipulator. Two are insulated with Armstrong's EF-22 Brick and one with EF-26 for the Key Company.

Armstrong's EF-22 Insulating Fire Brick assure maximum insulating efficiency in this oil-fired, Car Hearth Annealing Furnace, installed for Farrel Birmingham.



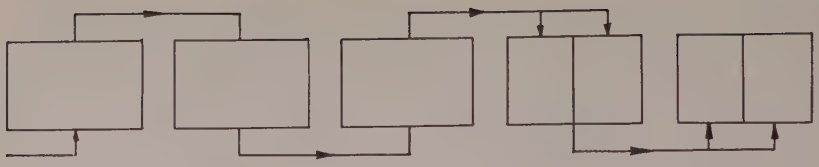


Fig. 2—Arrangement of presses handling the work

eter as shown at D, Fig. 1. In the fourth press, a second step is formed to produce the shape seen as E, Fig. 1. The second step is 4 inches long and 5¼ inches in diameter and total length or depth of the piece is now about 10 inches. The fourth press which forms this last step is a 2-stage press; that is, it has two working positions and two sets of dies. In the second set of dies in this press, another step is produced on the work, this last being 2 inches long and 4⅜ inches in diameter, see F, Fig. 1.

End Is Rounded

The work is now assuming a shape somewhat resembling the headlamp shell. In the fifth press, two operations also are performed as this is a 2-stage machine with two sets of dies. In the first stage, still another step is formed on the end of the shell, this last step being about 1½ inches long and 3 inches in diameter. In the second set of dies on this press a 1½-inch radius is formed on the end of the shell. The work now is about 12 inches long and 8 inches in diameter at the largest step with succeeding steps down to 3 inches in diameter at the end as shown at G, Fig. 1.

These operations are handled in a row of five presses as indicated in Fig. 2. Production on this line ranges between 450 and 500 pieces per hour. The operator at the last press in this row does not dump his work into a delivery chute as the other operators have done, but hangs the piece on a chain conveyor which takes the work through an annealing furnace. The length of this furnace and rate of travel through it are such as to produce a temperature of 1400 degrees Fahr. in the work for about 5 minutes. This thoroughly anneals the steel and prepares it for the final forming operation.

Coming from the furnace, work is transferred to another chain conveyor which carries it to a pickling bath. Pieces are now ready for the final forming operation which is done on a 200-ton hydraulic press. A piece is set in the lower die and the press tripped to slowly form the work to the final beautifully streamlined torpedo shape seen on the latest model General Motors' cars. The steps formed in drawing are smoothed out in this operation and no evidence of them can be seen in the finished piece except for a barely perceptible ring where each corner was. Even these rings, however. are removed in the final finishing operation. The final diameter is 8¼ inches at the largest point and the pieces are 12⅝ inches long.

From the hydraulic press, pieces are placed in a chute which carries them to another press where the excess flange is trimmed off. From this point the shell passes through a number of rolling operations which produce the slight bulge just inside the opening and which flange the edges of the opening to receive the headlight reflector and lens mounting. These various flanging and rolling operations are done on a number of machines set in line alongside a belt conveyor with dams at each working stage. When an operator has completed his work on a piece he places it on the other side of the dam in direction of belt travel, the belt then carrying the work to the next stage where the dam at that stage holds it until the operator is ready for it.

From flanging and final rolling operations, the shell goes to a special polishing setup which produces a perfectly smooth surface and which removes all forming marks. This setup, graphically shown in Fig. 3, includes several rather unusual features. It is mos that the grain produced b ishing operation shall be the length of the shell.

This is accomplished by mounting, specially dev handle this work. Then t placed on the end of a m shaft which in turn is piv a lever, the other end o pivoted at the floor level. a handle extending back motor and drive mechani holds the shell. The op gripping this handle can the shell against a vertica ing endless sandpaper b contact all portions of the

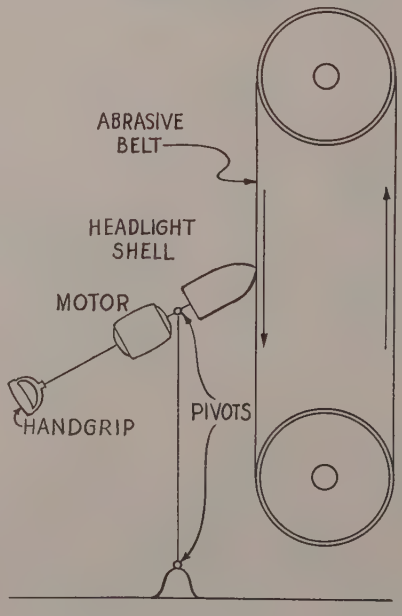
Since there is a motor t shell, at a constant speed, for the operator to obta form polishing action on

Finishing of these shel dled in two operations. I machine the endless abr is made of emery pap 2/0-100. In a second pol eration, the abrasive belt paper of 150 grade. Each els over a 12-inch diame which, being revolved at 7 tions per minute, produces high belt speed. The wo from these operations ver and with all the abrasi lengthwise of the shell w production of a perfect fi

From the polishing mac shells go to horning press mounting holes of variou and arrangement are produ

Following operations c cleaning, enameling and b desired finish on the she only the large head light s been described here, a sim is employed in producing lamp assemblies and other smaller size.

Fig. 3—High production setup for polishing the shells



How To Avoid Trou Under Wage-Hour

How to Operate Under t Hour Law, cloth, 248 pages inches; published by Alexan lishing Co. Inc., New York; by STEEL, Cleveland, for Europe by Penton Publis Ltd., Caxton House, Wes London S. W. 1.

This study of the new le is by Alexander Feller of Jersey bar and Jacob E. Hu the New York bar. It is a c signed for the businessma ing the course to be follow justing to the new conditi least trouble and expense. tion is in plain terms, un able by those with no know legal language.

It is a quick reference cedure and its arrangeme immediate access to answers lems arising in compliance regulations.

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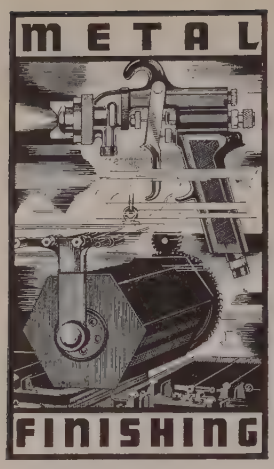


Reflection Factors

In choosing colors for large painted surfaces likely to affect illumination, the eye is often unreliable. Many times it is possible to select equally pleasing colors and yet to have a gain of 10 to 15 per cent in reflecting value

USING BOTH mercury and incandescent lighting, comprehensive scientific tests of reflection values from surfaces painted with 21 interior color variations have been made which may aid in choosing tints for best results with various lighting equipment.

Satisfactory painted surfaces free from objectionable specular reflection and in the range of lighter tints can be had with reflection coefficients easily in excess of 60 per cent, according to S. G. Hibben, director of applied lighting of the lamp division of Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. Of these tints, some of the greens, blues and grays will show a slightly higher reflection value under mercury illumination but the reverse is true for those tints containing pinks, buffs, tans or reddish colors.

For best lighting efficiency it is important when using mercury vapor lighting to have paints with good reflecting values at the particular wave lengths of light which are normally predominant in the output of the mercury lamp.

In the average interior when using an indirect or semi-indirect fixture, the character of the ceiling is vitally important. If this is a good white, the table top illumination is not greatly influenced by the colors or quality characteristics of the light source.

Long Wave Colors

Paints that under daylight appear to be pink, orange, red or mixtures of these longer wave colors should be avoided as the incident light is deficient in long wave colors. In a mercury lighted interior, the greatest efficiency is experienced if the longer wave paint colors are avoided.

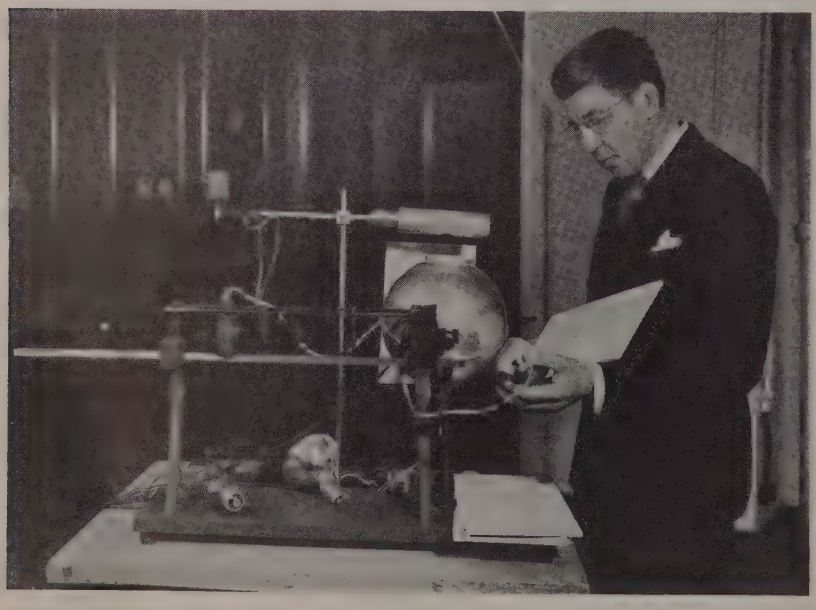
A series of measurements were made on 21 typical tints of painted surfaces, corresponding to commercial conditions. The basic standard of comparison was a surface of magnesium carbonate having a reflection coefficient of 98 [illegible]. The illumination from the lamp used corresponded to [illegible] um wattage Mazda lamps [illegible] average stores or offices. [illegible] cury illumination was from [illegible] ard 250 watt, high intensity, vapor lamp at about one [illegible] mospheric pressure, operat[illegible] stable temperature and a[illegible] rating. Illumination in all c[illegible] diffuse.

Tests indicated that of [illegible] average of 21 specimens, [illegible] efficient of reflection unde[illegible] illumination is about 2 [illegible] less than under mercury [illegible] tion. See Tables I and II

Reflective Values

To determine comparativ[illegible] tive values, the 21 tints [illegible] vided into three groups [illegible] samples each, a reflective c[illegible] group above 75 per cent, [illegible] from 60 to 74 per cent, and [illegible] group from 45 to 59 per ce[illegible] der incandescent examina[illegible] first group with whites, iv[illegible] light buff shades average[illegible] The second group contain[illegible] pinks, tans, blues and gre[illegible] averaged 0.644. The thir[illegible] with darker grays, greens a[illegible] averaged 0.534.

Under mercury lighti[illegible] groups shifted with only wh[illegible] ivory remaining in the first [illegible] for an average of 0.828. T[illegible] were incorporated in the [illegible] group for an average of 0.6[illegible] third group, with seven ti[illegible] an average of 0.550. Regar[illegible] this shifting, however, the a[illegible] for each of the three



Here Mr. Hibben is shown [illegible] reflectometer used in the t[illegible] scribed. Numerous measureme[illegible] taken on each specimen to [illegible] accurate average and to mini[illegible] man inaccuracies

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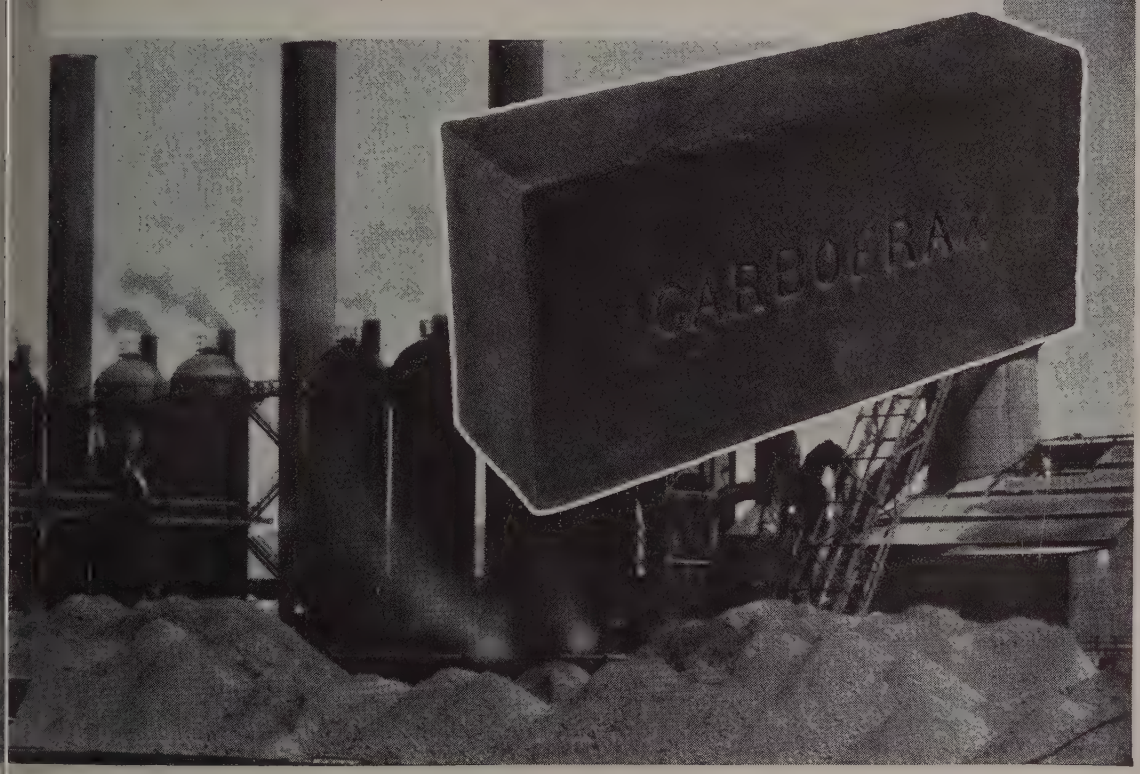

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TABLE I—Reflection Factor

Finish	Mercury Light	Mazda Light
Interior Satin White	.87	.85
Semigloss White	.86	.82
Interior Flat White	.81	.82
Ivory Semigloss	.77	.78
Suntone Satin	.72	.75
Light Buff Satin	.70	.78
Interior Satin Peach	.70	.72
Interior Satin Ivory	.69	.75
Satin Sea Foam Green	.66	.62
Sky Blue Semigloss	.66	.63
Dawn Gray Satin	.62	.57
Horizon Blue Satin	.62	.60
Blossom Pink Satin	.62	.67
Orchid Satin	.60	.64
Maize Tan Satin	.58	.63
Beige Satin	.58	.59
Apple Green Semigloss	.58	.57
Mist Gray Satin	.55	.53
Satin Cascade Blue	.55	.52
Palmetto Green Satin	.52	.49
Spring Green Satin	.49	.47

groups were in each case slightly higher than the corresponding Mazda section.

Inasmuch as all the specimens were of light tints, their ability to reflect light would not be radically different when illuminated by light of different quality. On the whole, specimens of white and near-white colors may reflect light from the mercury lamp to a slightly greater degree than from the tungsten lamp, but the reverse would be found with more nearly saturated colors such as red and orange.

The continuous spectrum of the filament lamp is relatively deficient in the short-wave colors or the blue-violet end of the spectrum. Light from the mercury lamp is changeable but is chiefly concentrated at blue, yellow, green and bright yellow.

In choosing colors for large painted surfaces likely to affect illumination, the eye is often unreliable. Selection should not depend on eye observation alone. Often it is possible to select equally pleasing colors and yet have a gain of 10 to 15 per cent in reflecting value.

With modern lighting equipment that in most commercial structures directs much of the light to the ceiling, areas above the general level of the picture molding should have reflection values of 80 per cent or higher. A general guide for interior colors may be found in nature's outdoor scheme, with the brightness of the horizon zone roughly half that of the sky, and the lower foreground half the brightness of the horizon. Presumably one would be on the right track to choose a ceiling paint of flat white or near white of about 85 per cent. The upper wall surfaces would have a reflection coefficient of about 45 per cent, and the lower walls and floors would be about 20 per cent.

TABLE II MAZDA ILLUMINATION

75% Up Group		60-74% Group		45-59% Group	
Satin White	.85	Satin Peach	.72	Beige Satin	.59
Flat White	.82	Blossom Pink	.67	Dawn Gray	.57
Semi-Gloss White	.82	Orchid Satin	.64	Apple Green	.57
Ivory Semi-Gloss	.78	Maize Tan	.63	Mist Gray	.53
Light Buff Satin	.78	Sky Blue	.63	Cascade Blue	.52
Suntone Satin	.75	Sea Foam Green	.62	Palmetto Green	.49
Satin Ivory	.75	Horizon Blue	.60	Spring Green	.47
Group Average	.793		.644		.534

MERCURY ILLUMINATION

Satin White	.87	Suntone Satin	.72	Maize Tan	.58
Semi-Gloss White	.86	Light Buff Satin	.70	Beige Satin	.58
Flat White	.81	Satin Peach	.70	Apple Green	.58
Ivory Semi-Gloss	.77	Satin Ivory	.69	Mist Gray	.55
		Sea Foam Green	.66	Cascade Blue	.55
		Sky Blue	.66	Palmetto Green	.52
		Dawn Gray	.62	Spring Green	.49
		Horizon Blue	.62		
		Blossom Pink	.62		
		Orchid Satin	.60		
Group Average	.828		.659		.550

Total Averages Mazda Illumination = .657 Mercury Illumination = .679

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■ A single-coat, liquid primer coating material t cold to a solid surface w hour and withstands tem up to 212 degrees Fahr. ha veloped by Self-Vulcanizin Co., 605 West Washingt vard, Chicago.

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More Steel Used in Burial Vault Bases

■ Until recently the base seal" steel burial vaults structed like inverted ca with the narrow edge r the ground and acting as support for the casket dome of the vault. This weight often caused the na support to cut into the e correct this condition Gali lic Vault Co., Galion, O., signed its line of vault make them nonimbedding.

These bases are constru heavy steel plate over t bottom, all of which cor earth and serves to sup casket and steel dome of From 30 to 40 more pound is used in each of these n than was used in the old t

German Text on M Machine Use in Fo

■ *Machine Molding* (M formerei), by U. Lohse; pages, 6 x 9 inches; publ Julius Springer, Berlin, supplied by STEEL, Cleve Europe by Penton Publis Ltd., Caxton House, Wes London S. W. 1.

Printed in German, this is one of a series of w handbooks and discusses various phases of molding chine. It covers principles ing machines, machines e some hand ramming, hand machines, pneumatic squee machines, squeeze-jolt centrifugal sand throwing and special molding proces ferent types of core mach are described. Final chap voted to a summary and r

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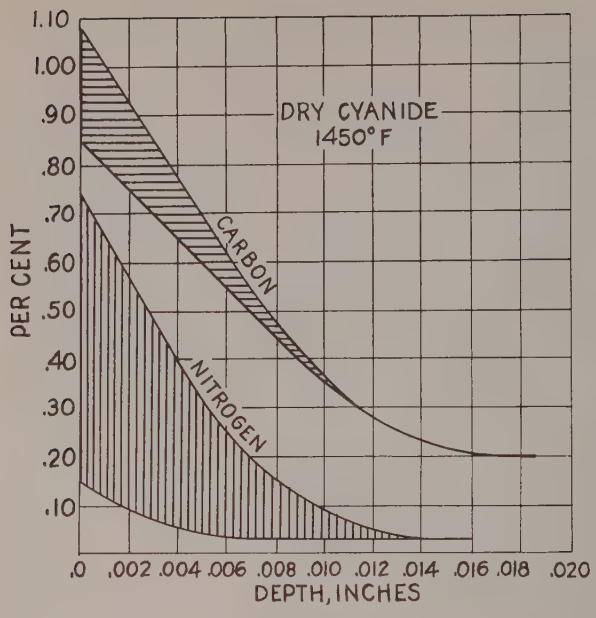
Compounding of Gase In Dry Cyaniding Giv Wide Range of Case



Range of carbide-nitride cases produced on S.A.E. 1020 steel by varying carburizing gases and proportions of ammonia used in conjunction with them

■ PROGRESS of research on the subject of dry cyaniding (STEEL, Feb. 21, 1938) was outlined by R. J. Cowan, metallurgical engineer, Surface Combustion Corp., Toledo, O., in a recent address on superficial hardening, before members of the Detroit chapter of the American Society for Metals.

Combination of nitriding and carburizing heat treatments to produce thin cases on a wide range of steels is meeting increasing commercial acceptance, but Mr. Cowan pointed out that research work done by his staff has indicated a tremendous range of properties can be produced by slight variations in furnace conditions, proportion of carburizing to nitriding gas, quenching, etc. For example, the accompanying chart shows the range of case compositions which have been produced on S.A.E. 1020 steel by varying the carburizing gases and the proportions of ammonia used in conjunction with these gases.

Composition Selected

It is possible, Mr. Cowan observed, to select the desired composition from such a chart and then to compound the gases in such a way as to produce cases of any chosen type in a continuous manner. In these experiments, the proportion of ammonia in most cases averaged well under 30 per cent.

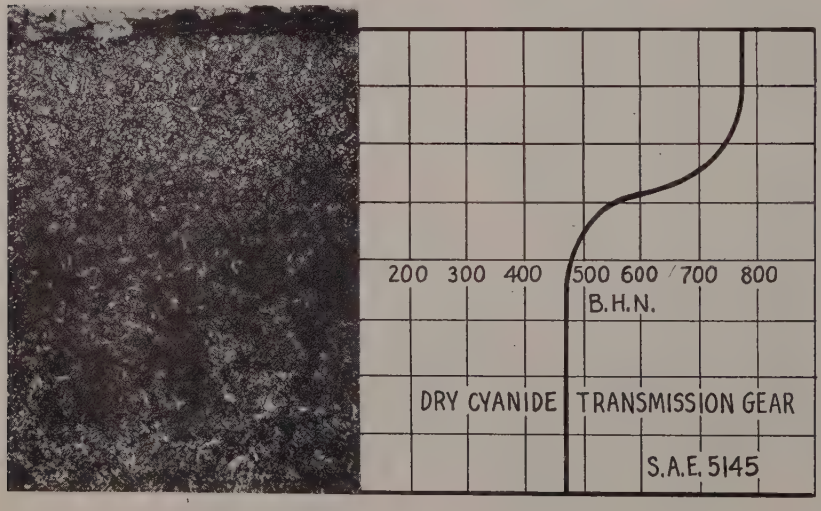
An accompanying photomicro-

Microstructure typical of a cooled dry cyanided specimen ing extreme surface brittleness jectionable nitride needles.

graph and hardness curve sh sults of dry cyaniding a tr sion gear of S.A.E. 5145 stee micrograph was made from a through one of the gear teeth had been subjected to a dyn eter test which was twice a as the usual life of the test The original magnification diameters and the original c ruled in ½-inch squares. A ingly the hardness at di depths may be seen by comp with the adjoining chart-two s representing a depth of 0.003

A second photomicrograph a structure typical of a slowly specimen which has been pr in such a way as to avoid ex surface brittleness and object nitride needles. While hardn not as great as that of a qu specimen, it is still file har suitable for many purposes.

Illustrating depth of case and microstructure on dry cyanided transmission gear of S.A.E. steel by plotting brinell hardness number at different depths. Two squares on chart are equivalent to 0.0033-inch on the specimen



An Alloy Steel House

...re is the completed alloy steel house, a compact dwelling with five ...nd bath. At the right is the utility room of the new home, comprising the heating plant and automatic clothes drying unit

...GNED to overcome the shortcomings of earlier ...ses and those of wood and masonry construction, ...st dwelling of rigid alloy steel construction has ...veloped by Youngstown Sheet & Tube Co. in co-...n with Book-Reese Realty Co., Youngstown, O. ...ne will be constructed anywhere in the United ...r a standard price of $5000.

...se a rust-resisting alloy steel, known as Yoloy, ...n its construction, this house is said to be adapt-...any climate or atmospheric condition. It will ...de, nor warp as does wood, nor dry out as does ...sonry. Interior walls are soundproofed with a ...ion material, eliminating the "clatter" encount-...some earlier steel houses. This effective insula-... distinct advantage in noisy urban locations.

...ling to the builders, the rigid steel construction ...w house gives it sufficient strength to withstand ...al wind velocities up to 300 miles per hour, af-... ample protection in earthquake or hurricane zones. By its very nature this type of construction is fire-resistant and is uninteresting to termites. The only wood used is found in the doors and flooring. Being set in a mastic composition through which termites cannot penetrate, floor is amply protected. Layers of air beneath the roof and between the walls provide effective insulation, and modern air-conditioning equipment makes the house suitable for either hot or cold climates.

Since the type of steel used in this construction is little affected by humidity and temperature, time does not loosen nails, causing floors to warp and windows to rattle. In this house 2½ tons of carbon steel are used for the frame, outer wall panels and decorations. Outer walls are painted and may be washed with a hose.

This is a one-story house, without a basement. It has five rooms, including living room, kitchen and dinette, two bedrooms, bathroom, and a utility room combining heater, air conditioning unit, laundry and automatic clothes drying unit. The roof is flat and is designed to serve as a play space for children. According to the architect, this dwelling is intended for the family that prefers the privacy of a single-family house and yet like the compact convenience found in the modern apartment house.

(Left) Steel framework of the new dwelling is designed for simple and inexpensive erection. Bridge type girders give this house high rigidity and storm resistance. (Below) Kitchen and dinette, showing compact, convenient arrangement

Presents Review of the Nickel Industry in 1938

■ General survey of the nickel industry in 1938 has been prepared by Robert C. Stanley, chairman and president, International Nickel Co. of Canada Ltd., Copper Cliff, Ont. Significant figures detailing world production and consumption are outlined. The text is divided into sections according to industries in which new applications of nickel were developed during 1938. Basic nickel products, such as alloy steels, are discussed in another section. Under special products, Mr. Stanley points out increased use of nickel in the coinage of various countries. Copies of this review may be obtained from the company.

Broaching and Machining Lubricant Is Introduced

■ Especially adapted for use in vertical and horizontal broaching machines, and for lathes, a new machining lubricant has been developed by Wayne Chemical Products Co., Detroit, and is being marketed under name of Aqua Sol "C" compound.

This lubricant mixes readily with water, and the average s eight to ten parts of wat part of the base compou tion is said to be efficien ing purposes and to pro finishes on parts being br machined. Cleanliness of uct eliminates necessity fo cleanups around machine

Insulating Materia British Meeting To

■ British joint committe terials and their testing izing a discussion on "Prop Testing of Heat Insulatin als," which will take place London in connection wit tumn meeting of the Inst Gas Engineers.

The discussion will be c to three sections: (1) perature insulating mat low-temperature insulating and (3) insulation of buil other applications. It is that the papers will review ent position of research an opinion, not only in Gre but also on the continen the United States. Consid terest is evident in this su

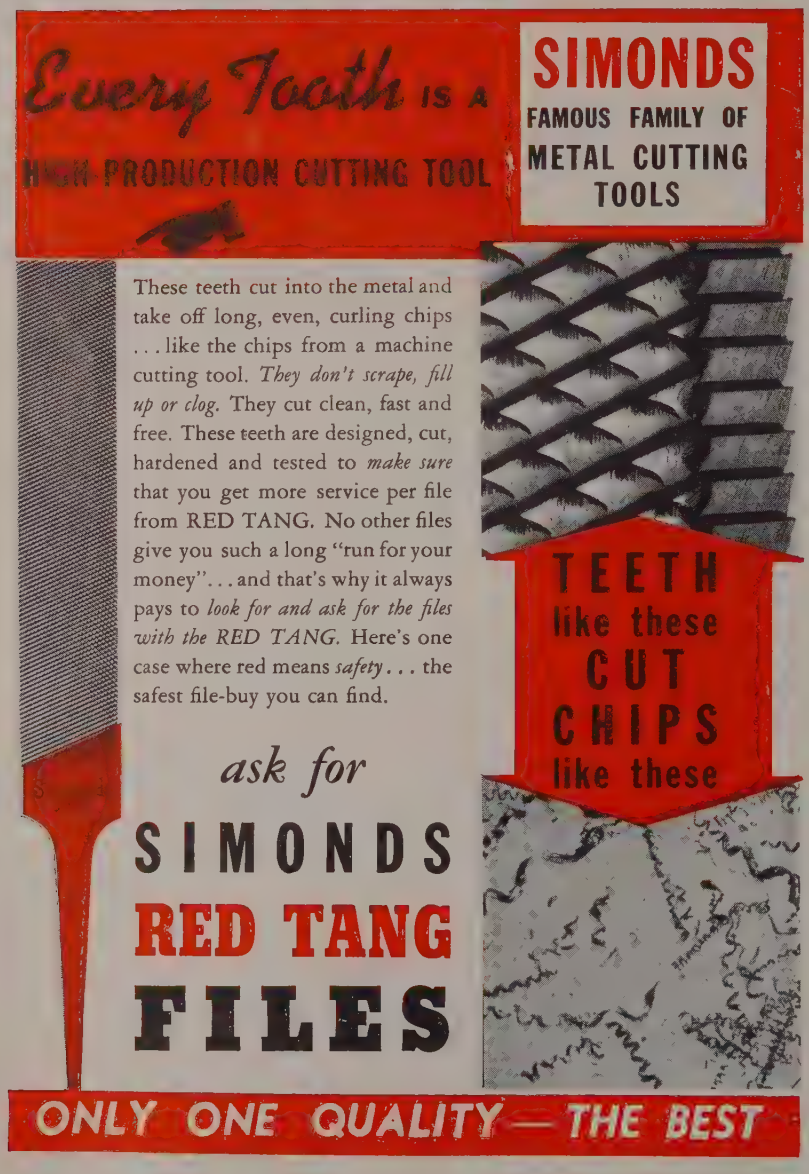
National Income in United States Anal

■ *National Income in th States*, 1799-1938, by Rober tin; cloth, 146 pages, 6 x published by National I Conference Board Inc., N supplied by STEEL, Cleve $3.50; in Europe by Penton ing Co. Ltd., Caxton Hou minster, London S.W.1.

This study offers the m plete estimates of nationa in the United States that able, for the 140-year p ginning in 1799. Since tha come received by individua United States has increas less than one billion doll peak of almost $80 billions falling to an estimated $62 1938. In terms of goods and purchasable with the do ceived, the national inc capita increased nearly in the 140-year period.

Sources for each year an are estimated by kind, wages, entrepenurial incor dends, interest and rent, an dustrial origin, agriculture, manufacturing, constructi others.

A chapter deals with the government as a direct s personal income from 1 in 1799 to a peak of 20 of the total in 1936.


Every Tooth IS A
HIGH PRODUCTION CUTTING TOOL
SIMONDS
FAMOUS FAMILY OF
METAL CUTTING
TOOLS
These teeth cut into the metal and take off long, even, curling chips . . . like the chips from a machine cutting tool. They don't scrape, fill up or clog. They cut clean, fast and free. These teeth are designed, cut, hardened and tested to make sure that you get more service per file from RED TANG. No other files give you such a long "run for your money"... and that's why it always pays to look for and ask for the files with the RED TANG. Here's one case where red means safety... the safest file-buy you can find.
TEETH
like these
CUT
CHIPS
like these
ask for
SIMONDS
RED TANG
FILES
ONLY ONE QUALITY — THE BEST

oods at Lower as Business Aid

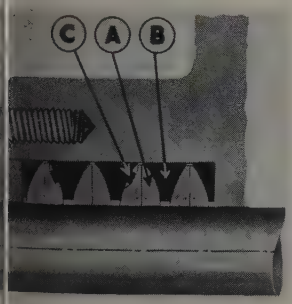
rial Price Policies and Progress, by Edwin G. nd Horace B. Drury; 314 ublished by the Brookings h; supplied by STEEL, Cleve- $2.50; in Europe by Pen- ishing Co., Ltd., Caxton Westminster, London,

thors of this study empha- need for business execu- plying all their ingenuity erience toward producing ds at lower prices so that sumption may make it pos- attain full economies of duction.

d for increased govern- sponsibility for providing ent for the nation's mil- unemployed can be dim- nly if employment is pro- private industry. Business cannot afford to go out men unneeded. But numer- ustries have contributed reducing prices, expanding nd raising the existence he people as a whole. Such reate jobs. The book pro- m the general analysis de- n a former Brookings In- publication, *Income and Progress.*

ps Rod Packing vere Conditions

ue type of rod packing, de- by Rodpak Mfg. Co., San , is specifically designed e service conditions. It em- metal rings, shown in the ying illustration as A, the



tion of rod packing, showing gs (A), Neoprene rings (B) yllium copper springs (C) revent packing from turning with the rod

medium on the shaft. On plications these are babbitt nd on others a metal that st up to 700 degrees Fahr. these sets of rings are Neoprene (B), which are concave on both faces so that they mate with convex faces of the metal rings. Beryllium copper springs (C) are embedded in the Neoprene rings and seat themselves in recesses in the metal rings. These copper springs prevent packing from turning with the rod on centrifugal units. On reciprocating rods, springs are so placed as to exert an inward and downward pressure to offset any irregularity of the rod.

This construction is said to provide a floating seal under all conditions. The metal rings seal the rod but do not touch the stuffing box. Neoprene rings seal the stuffing box but do not touch the rod. As only the metal rings touch the rod, coefficient of friction is low.

A typical application of this type of packing was made on a compressor which handles a combination of hydrogen and nitrogen at a pressure of 170 pounds. Here the new packings lasted ten months, whereas it was formerly necessary to pack the unit weekly. The new packing has been used successfully also on pumps handling emulsified asphalt containing caustic soda and on a pump handling hot kerosene at pressures ranging from 5000 to 8000 pounds.

*U. S. Patent 2,121,656

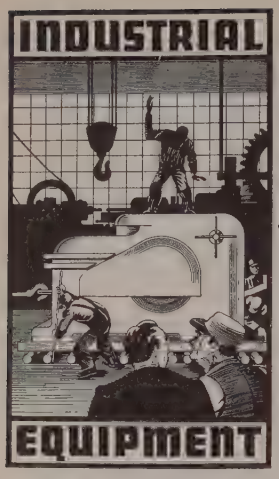
RED STREAK FLANGES

For High-Speed Resinoid Bonded ABRASIVE COMPANY GRINDING WHEELS

SIMONDS FAMOUS FAMILY OF METAL CUTTING TOOLS

Consist of two circular steel flanges or plates permanently embedded and bonded into the sides of large hole resinoid bonded wheels adjacent to the center hole and lining a portion of it. Available in wheels with 6" and 12" hole sizes. Write for Bulletin ESA 56 for complete description. Distributors in all industrial centers.

ABRASIVE COMPANY
Division of Simonds Saw and Steel Co.
Tacony and Fraley Sts., Philadelphia, Pa.
Chicago Branch: 1624 South Western Avenue



Screen Removes Solids From Waste Water

■ Link-Belt Co., 307 North Michigan avenue, Chicago, has developed a mechanical vibrating screen for efficient removal of solids from factory waste water.

Screen has surface of 2 x 4 feet or

4 x 5 feet and employs fine mesh stainless steel, screen cloth. It is a compact, self-contained unit, furnished complete with steel collecting tank under screen cloth. Motor is 1 or 2 horsepower, depending on size of screen, and is mounted on top of screen's steel framework.

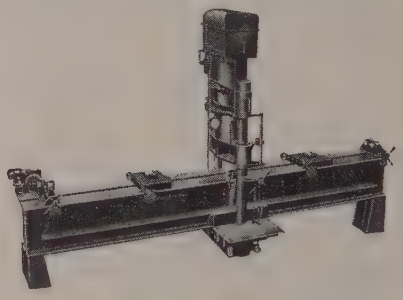
It has been applied at a steel mill for removal of slag that was light enough to float out into stream adjoining the mill's quench pit.

500-Ton Press Built For Government Arsenal

■ A. B. Farquhar Co., York, Pa., has designed and built a 500-ton press for straightening gun barrels and heavy shafting at the Watervliet arsenal.

Press was built in accordance with government specifications. Bed of machine, which is 32 inches wide and 26 feet long, is made of heavy structural steel sections riveted together and machined on top surface for guiding various parts. Pressing unit of machine is of 500-ton capacity supported by means of wheels on bed of machine. Wheels are equipped with roller bearings to minimize friction for movement of pressing section of machine from one end of machine to the other. Press has travel speed of 120 inches per minute.

Press is equipped with revolving mechanism for checking work be-

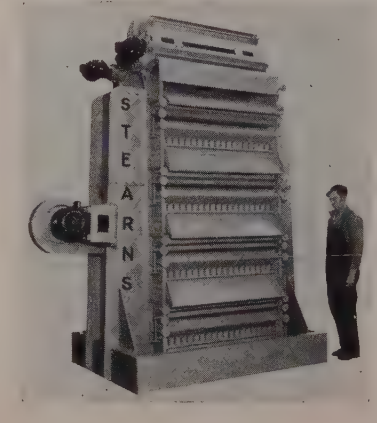


fore and after straightening. End has a motorized unit controlled by means of pendant switch having provision for jogging operation. Straightening operation proper is done on pressure blocks which raise and lower work from revolving heads. Revolving heads and pressure blocks are adjustable with respect to pressing unit. Press has two different speeds which are accomplished automatically at any predetermined set position of moving platen. As a safety device, pit on front of machine is covered with automatic cover which follows motion of pressing unit of machine.

Eliminates Air Gaps in Huge Magnetic Separator

■ Stearns Magnetic Mfg. Co., 620 South Twenty-ninth street, Milwaukee, has built one of the largest magnetic separators ever manufactured, designed for treatment of ore in South American mining operation.

Separator weighs 36,000 pounds, has an overall height of 12 feet and



measures 5 x 7 feet at base. Simplicity of design and operating principle, elimination of mo
ments such as conveyor b
and for reduction of bear
minimum are features. A
separating zones have be
nated.

Material is fed by an ag
ciprocating feeding eleme
distributes it in a uniform
to various separation fiel
of flow and point of conta
terial with premagnetizing
adjustable to permit max
pacity and highest attaina
in separation by various
through the magnetic se

Introduces Multipl Purpose Machine T

■ Hack Machine Co., 44
Oakley boulevard, Chica
placed on the market a
purpose machine tool, know
Multi-Versal, applicable to
ciprocating and rotary cutt

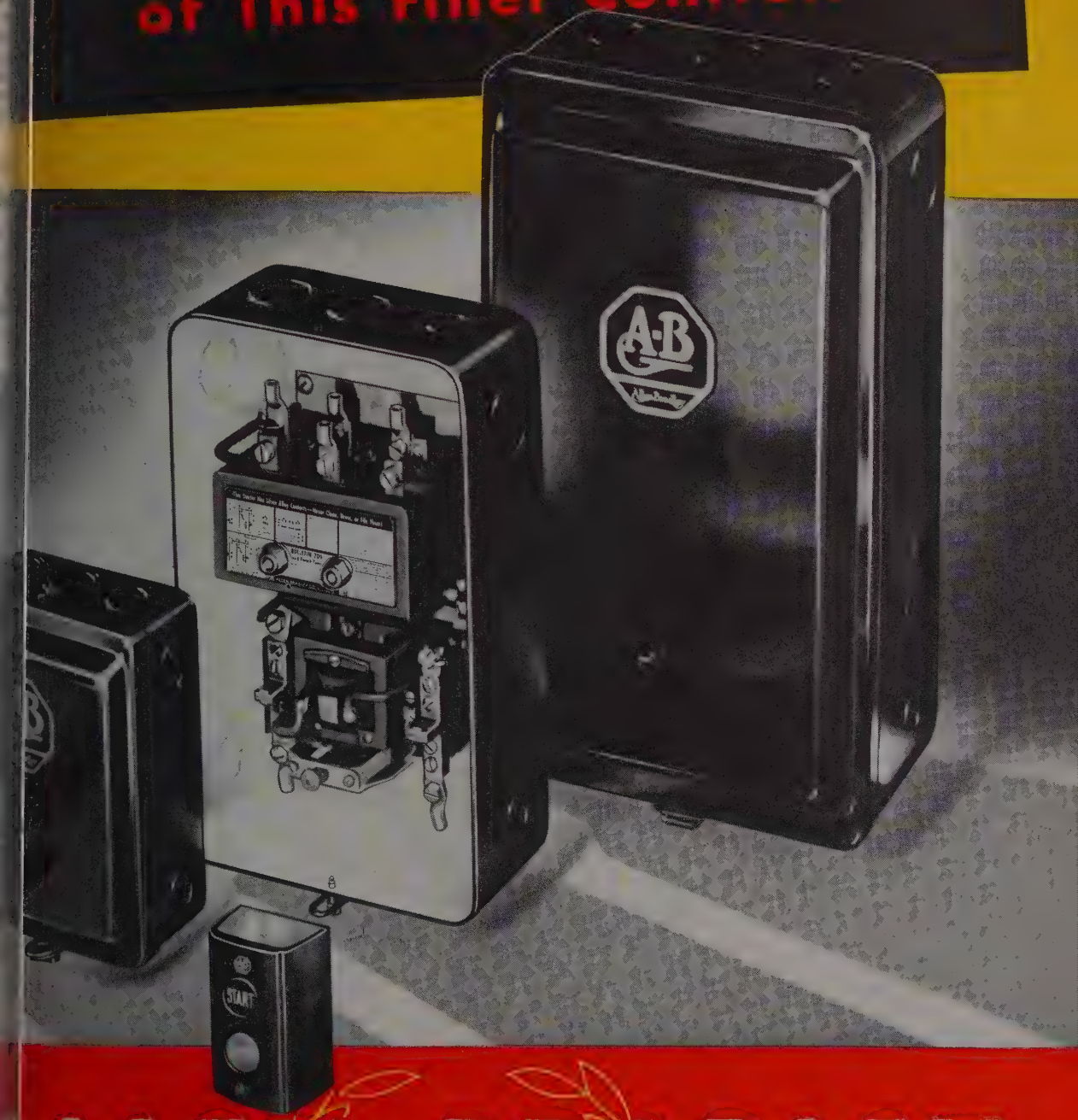
to the built-in reciprocating
master head, changes from
cating to rotary motion req
the selection of one of tw
buttons. Instantly attachabl
ers and heads, fitted to the
head, complete the setup.

Rear ram serves as a
column, having a reciprocat
tion adjustable from ½-inch
inches. Master head is a
tained horizontal milling u
ceiving its power through
from a motor adjustably a
to it. Six back-geared spe
provided, suitable for driv
ters ranging in size from
end mill to an 8-inch fa
Master head serves as a car
all removable attachments.

Feed screws geared dow
the handwheel to permit s
movement of the compoun
which measures 18 x 30

(*Please turn to Page*

Give Your Machines EXTRA SALES ADVANTAGE of This Finer Control!



ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

QUALITY

...mple, rugged construction, the attractive modern appearance, and the time-tested relia-
... of Allen-Bradley motor controls make these units a valuable asset in selling your machines.

"TROUBLE?
-Not with Allen-Bradley Contro

"I always thought motor starters were the 'weak links' on our machines. But
installed those Allen-Bradley solenoid starters, I've changed my ideas a lo
starters are in almost continuous operation, yet they never give us any
Believe me, when we need more starters, I'm going to be sure they're Allen-Br

A NEW Push-Button Station

New in Styling

Note the clean, modern appearance of this new Bulletin 800 push-button station. With its glossy black, heavy bakelite cover and sturdy die cast frame, it is the ideal "start-stop" station for any general purpose application.

New in Ideas

The silver-to-silver contacts are located where dust and dirt must do tricks to get at them. Yet the terminals could not be more accessible. Removing the cover completely exposes the push-button unit, making the wiring of the button a "cinch." Ask your Allen-Bradley representative to show you this new A-B push-button station.

THE MOTOR STARTER THAT'S *TROUBLE-FREE*

Simple Construction

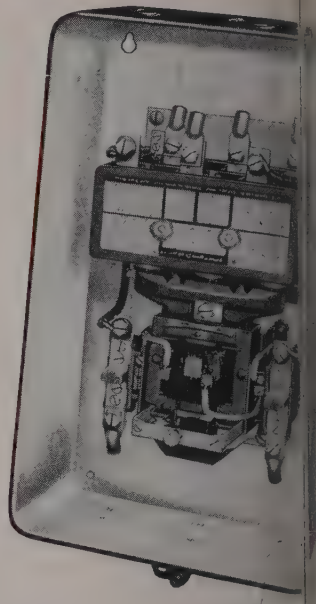
No bearings, no pivots, no complicated mechanisms—that's the secret of the Allen-Bradley solenoid starter's long and trouble-free performance.

No Contact Maintenance

You never have to file the double break, cadmium silver alloy contacts. That's one reason why they last many times as long as ordinary contacts.

No Unnecessary Shutdowns

Because of the efficient solenoid action and straight-line motion, welded contacts and shutdowns caused by poor line voltage conditions are avoided.



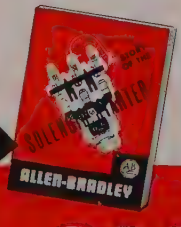
Bulletin 709, Size 2, across-the-line s
starter for squirrel cage induction m

Rugged Parts

This simple starter has few parts. They are extremely rugged and will withstand abuse.

Overload Protection

Two eutectic solder overload
protect the motor from sust
overloads. They are reset by pr
a small button on the cabinet



Send for "The Story of the Solenoid Starter"

Allen-Bradley Company
1320 S. Second Street
Milwaukee, Wisconsin

Please send me a copy of "The Story of the Solenoid Starter."

Name ----------

Company ----------

Street ----------

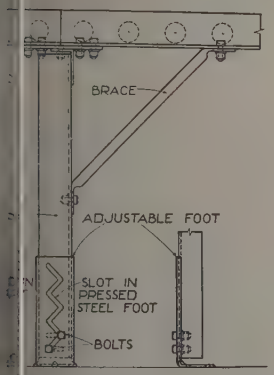
City ---------- State ----------

ALLEN-BRADL
SOLENOID MOTOR CONT
QUALITY

dials are provided for
d and lateral movements.
indle has speeds of 750,
and 2500 revolutions per
d head can be revolved
s around master spindle.
tion high speed die filer
r is driven from the
ad or can be attached to
er head. Combination
s two spindles, one for a
and one for small bore
emovable hacksaw frame
lace on right side of the
d, and is usually used in
with the elevated table.

events Conveyor : from Slipping

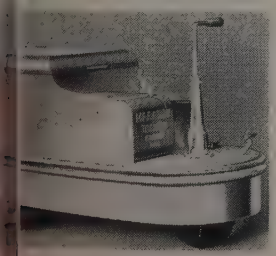
o., Louisville, Ky., has an-
new type of adjustable
ort for conveyors.
lot in adjustable foot por-
nveyor floor support pre-



ping under heavy loads.
al type of floor support
vertical slot in foot por-
leg being adjusted in
vertical movement and
nuts and bolts at de-
ion. New zig-zag slot will
n position without neces-
awing up nut extremely
rect alignment for carry-
e of conveyor is main-
uring proper operation of
and simplified adjust-
eight.

Wheel Steers Tread Tractor

Mfg. Co., 4044 South
treet, Chicago, has an-
a new narrow tread,



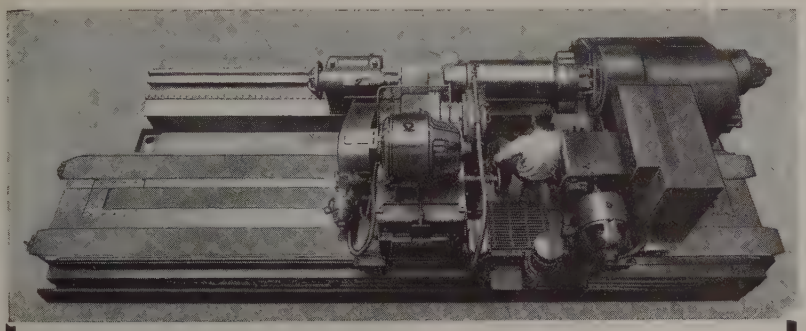
streamlined, electric tractor, 32 inches in overall width and rated at 500 pounds normal draw-bar pull and 1000 pounds maximum.

Frame of tractor is channel iron, shrouded and streamlined by welded steel plates into an integral unit, including battery compartment and operator's seat. A heavy rubber bumper is provided extending around entire exterior of machine. Tractor is available with stainless steel body and chromium plated exposed running gear for special institutional service. Enamel finish is standard.

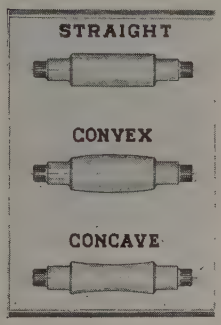
Drive axle is of worm reduction type with transverse semi-elliptic spring suspension. Drive tires are size 20 x 3½ inches. Steering is single wheel type with 15 x 3½ inches rubber tired wheel. Drum type controller provides three travel speeds forward and three reverse.

Announces Changes in Flexible Coupling Line

■ Charles Bond Co., 617 Arch street, Philadelphia, announces changes in five intermediate sizes of the BONDTRU flexible insulated coupling, resulting in greater horsepower



FARREL HEAVY DUTY ROLL GRINDERS



Grind Straight, Convex or Concave Contours to Exact Symmetry and Accuracy

The quality of surface and accuracy of gauge of rolled metal strip and sheet depends upon the finish and accuracy of the rolls through which it is passed.

Farrel Heavy Duty Roll Grinders grind rolls of any material with extreme precision and with any desired finish which can be obtained with wheels at present available. They are equally capable of heavy roughing or fine finishing and produce a perfect surface free from marks of any kind. Straight, convex or concave contours are ground to exact symmetry and accuracy.

Automatic and semi-automatic features reduce dependence upon the skill of the operator to a minimum, removing the shaping and finishing of rolls from the class of craftsmanship and enabling the plant management to control roll accuracy and finish in accordance with predetermined standards.

For full information send for Bulletin No. 111

FARREL REG. U.S. PAT. OFF.

FARREL-BIRMINGHAM COMPANY, Inc.
ANSONIA, CONN.
New York • Buffalo • Pittsburgh • Akron • Chicago • Los Angeles

ratings and larger maximum bores.

These couplings have been redesigned to use inserts with six radiating arms, providing three driving points of contact instead of the former 4-arm insert which provided only two driving points of contact. Flange hubs have also been enlarged to permit boring for larger shaft sizes.

A ¼-horsepower size coupling in 38 different lengths, ranging from the standard 1 9/16 to 5 11/16 inches, has been added. These are made up of combinations of various length flanges, longer couplings having one or two Bakelite extension members added. Flexible inserts of special oil-proof rubber and cork composition, or leather, separate each metallic or Bakelite member from adjoining member and adds to flexibility of coupling.

Swivel Coupling Joints Bear On Ground Surfaces

■ Oseka Bros., 3 East avenue, Elyria, O., announce a line of Giberson packless swivel couplings in sizes from ⅛ to 1½ inches. For air or liquid lines, this type of swivel does not use compressible packing. Joints bear on ground su will swivel satisfactorily sures of over 4000 pounds p inch. When assembled, sw

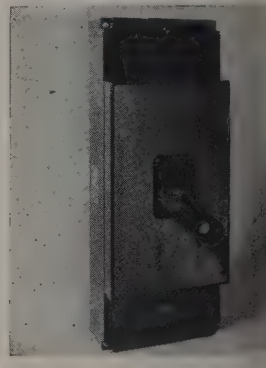
filled with a heat-resistin which will withstand 370 Fahr., before melting. Sw furnished with brass body top, or all-steel.

The straight hose swiv been approved by safety i who consider them as safet as well as a means of eli kinks and twists in the hos couplings for air tools ca nished with alemite greas permit greasing tool witho ting off air or disconnecti from tool.

Circuit Breakers H Silver Alloy Contac

■ Westinghouse Electric & East Pittsburgh, Pa., has a an air circuit breaker of 2 pere interrupting capacity, for circuit protection of m tribution feeders in central industrial plants or buildin ment.

They are available in w ratings of from 70 to 600 and for voltages up to an ing 600 volts on alternating or 250 volts on direct curre



claimed newly developed silv contacts assure positive cont provide maximum prote against welding on heavy sh cuits. Circuit breakers have taneous magnetic-trips whic ate at from 9 to 10 times t rating. Composition is us breaker housings. Ribs betwe permit minimum spacing and est overall dimensions.

Obsolete methods!

BOOST COSTS

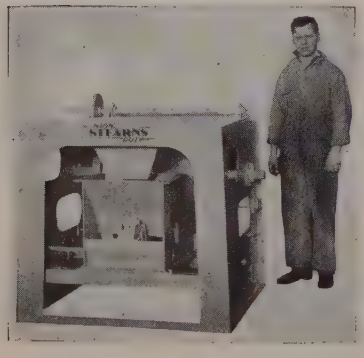
Bigger sales and greater profits are the result of smart management and new and improved machinery and equipment. It is expensive economy to "make the old machine do".

STEARNS improved, better designed and better built electro-magnetic equipment will definitely help you get economical, smooth, trouble free production.

Use STEARNS magnetic clutches and brakes for efficient transmission control; STEARNS magnetic separators for a purer product and protection of processing machinery.

One of the many new and improved types of Stearns Magnetic Separators available for purifying various types of materials. More efficient, more economical.

Investigate STEARNS magnetic equipment now!



STEARNS

MAGNETIC MFG. CO.

SEPARATORS CLUTCHES
DRUMS BRAKES
ROLLS MAGNETS

BETTER MACHINES
FOR BETTER SEPARATION

650 SO. 28 ST. MILWAUKEE, WIS.

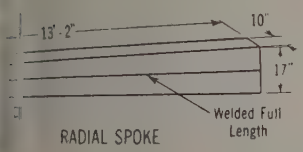
Pot Chuck

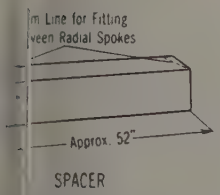
cluded from Page 65)

were welded together in assembly. Entire central on is 5 feet in diameter, inner ring is 30 inches in- eter, 30 inches wide. It by flame cutting and bend- l plate 2½ inches thick.

elded steel pot chuck 6,200 pounds, about 8800 less than its estimated cast iron. The weight e been decreased still fur- rigidity characteristics of iron design were only However, it was found l in steel construction to only a medium weight re- ut also to obtain increased

l gears cut on this pot e made in six segments, l in the chuck on an in- g shelf which is welded





f box section spoke and ed in the welded steel pot chuck

bottom to the inside sur- he main web and rigidly by 48 auxiliary ribs, close- . These ribs are matched e of main web by an equal f ribs running full depth eb, all ¾-inch thick.

uter ring was formed of flame cut and bent. These re 14½ x 2 inches for the and 26 x 2 inches for bot- . When fitted together, ht segments formed two feet 7 inches outside diam- in ring web of 2½-inch te was bent to 31 feet 2 tside diameter.

el plate entering into the on of the pot chuck was welding quality furnished s Steel Co.

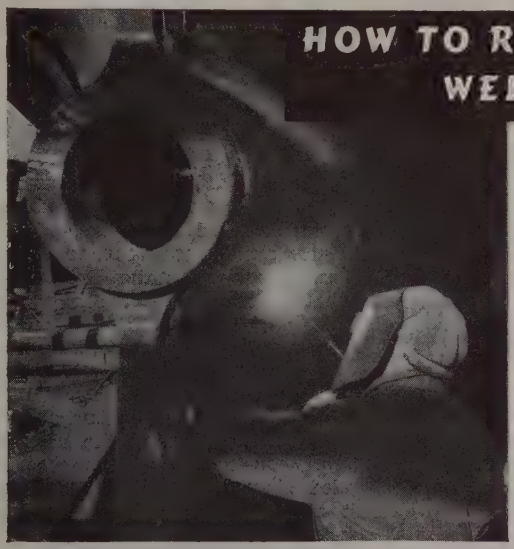
ipment, the two half sec- he pot chuck, each measur- et 10¼ inches high, were a well-type flat car and n place. Halves had only 3-inch clearance from the rail, instead of the usual 6 inches. Clearance under certain overhead structures was only 1 inch. Train speed was limited to 20 miles per hour, and instructions given to handle the car with extreme care.

After arrival at Camden Forge Co., assembly and welding was completed in 12 working days.

Using the same special furnace designed and built for the heating operations on the internal gear forgings themselves, Camden Forge Co. stress relieved the finished pot chuck in one piece. Then top edge of main ring and inside surface down to and including top surface of inner shelf was machined to close limits. Outside diameter of top and bottom ring flanges and their top surfaces also were machined.

Pot chuck and slotter will be placed on a floating foundation to insulate them entirely from all outside vibration. Entire assembly will weigh approximately 1,000,000 pounds.

Each internal gear to be slotted will be in six segments and will be set up on the internal shelf of the pot chuck and bolted in place. The chuck will be rotated on rollers and the indexing accomplished through microscopes mounted on the slotter.



HOW TO REDUCE YOUR WELDING COSTS

From coast to coast, in plants fabricating welded structures of every description, Murex electrodes are helping to reduce welding costs. The reasons why are many. In one plant high burn-off rate may prove an advantage. In another, rapid deposition, or lack of spatter and smoothness of deposit may do the trick.

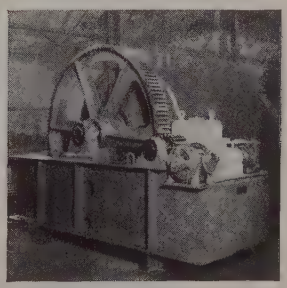
There is little question but what, in your plant, too, these Murex features can effect real economies. Why not write today and ask to have a representative demonstrate Murex. No obligation is involved. And, if you have a problem or two concerning welding procedure, his broad experience may prove extremely useful.

1 In marine work, vertical and overhead welding goes easily and quickly with Murex Vertex (reverse polarity) or Genex (straight polarity). *Photo courtesy Ira S. Bushey & Sons Co., Inc., Brooklyn, N. Y.*

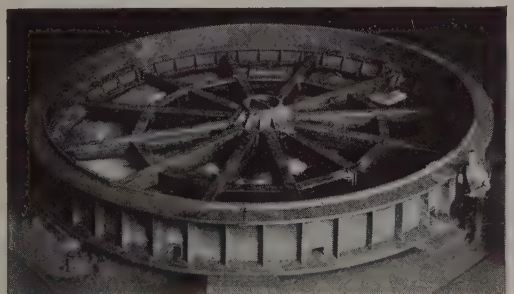
We've a pocket-size pamphlet giving properties of all electrodes in the Murex line. Send for your copy.

2 Only 2700 lbs. of Murex welded this 40,000 lbs. jacketed still. *Photo courtesy John Nooter Boiler Works Co., St. Louis, Mo.*

3 High speed deposition saves time and money on the Lorain 79 Shovel. *Photo courtesy The Thew Shovel Company, Lorain, Ohio.*



5 Economy of welding machinery such as this sluice gate hoist is increased by time-saving Murex Electrodes. *Photo courtesy Lakeside Bridge & Steel Co., Milwaukee, Wis.*



4 Free-flowing Murex downhand electrodes speeded welding on this 96,200 lb. pot chuck, 33 ft. 7 in. in diameter, believed to be world's largest. *Photo courtesy Lukenweld, Inc., Coatesville, Pa.*

MUREX
HEAVY COATED
ELECTRODES

METAL & THERMIT CORPORATION
120 Broadway, New York, N. Y.
Albany • Chicago • Pittsburgh
So. San Francisco • Toronto

Electric Motor Cores

(*Concluded from Page* 63)

truck skids have a welded angle iron framework in which two rows of stacks are carried. In Fig. 3 the operator is just beginning to form a stack in the first position along one side of this carrier.

As will be seen in Fig. 2 the motors driving the belt conveyors and stacking disk mechanism are connected directly to the press through flexible cables so they all start automatically as soon as the press motor is energized since they are all on on the same electric circuit. Thus the entire equipment starts simultaneously as soon as the operator feeding the press places the press in operation.

Producing almost 26,000 laminations per hour, the completely automatic conveyor mechanism described is most essential to obtain maximum output on the cookie press. There are two of these complete layouts at this plant that is, two cookie presses, each with complete conveyor and stacking equipment as described. Cookie disks produced by these presses now go either to an automatic press setup for punching rotor and stator slots or to conventional notching presses where the coil slots are punched slot by slot in each piece individually.

Also in this same room are a number of other stamping and forming presses used to make such items as feet for the motors, mounting brackets and similar parts. This equipment includes a 600-ton blanking press and three forming presses rated 800, 500 and 250 tons respectively. In addition there are a number of other smaller presses.

Typical work handled by these presses is production of heavy feet. Steel stock 7/32-inch in thickness is blanked and then goes through three forming operations and two piercing operations to make a completed motor foot. The maximum thickness which can be handled is ¼-inch. In addition to the blanking and forming presses mentioned, a 50-ton piercing press is used for the piercing operation. These heavy motor feet are produced at a rate of 500 to 600 per hour. They are handled through the plant in large skid boxes as shown in Fig. 5. This view also shows a number of the large presses employed in this work.

(*Part II will appear next week*)

♦

Light Alloys Reduce Car's Weight One-Third

■ Extruded aluminum shapes joined with the new "squeeze rivets" make possible one-third saving in weight in a new rapid transit car, recently put into service on the Brooklyn-Manhattan transit system in New York.

Rubber-sprung and equipped with safety glass windows and plate glass interior mirrors, the car was built by Clark Equipment Co., Buchanan, Mich., which developed the rivets.

Rivets consist of a soft steel sleeve banded about a harder shaft; the soft steel is squeezed into place, forming a strong bond without heating or hammering and permitting rapid assembly when the work can be approached from side.

Eastern Founders Discuss Problems

(*Concluded from Page*

were correct. "It generall essary either to standardize sand properties and vary t arrangement, or standardiz ing and vary the molding s erties for best results."

Normal L. Mochel, Wes Electric & Mfg. Co., Phil discussing castings from sumer's viewpoint, urged lationship between produ buyer. Each, he said, m realize that the other mu a profit and then analyze tual problems in advance in close touch during proc

Visualizing an "ideal" for purposes of discuss Mochel said the buyer e casting salesman to know uct and is appreciative of v high-grade contact man, an preferably. The consume possible, should have a fou pert on his staff. The should promptly report ba defect, with a sketch.

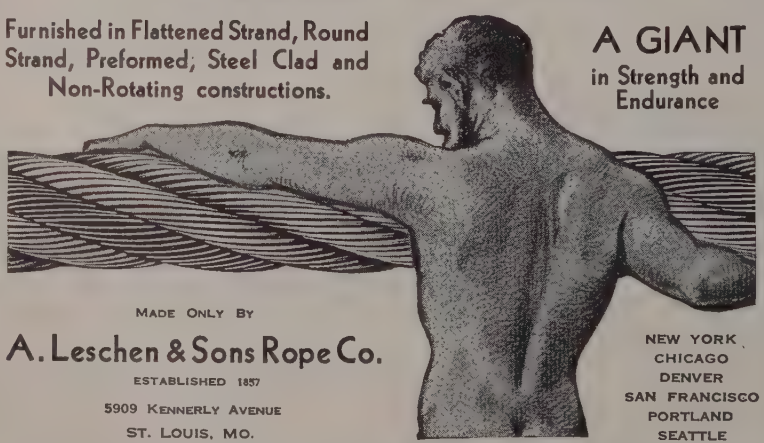
While admitting the idea troversial, Mr. Mochel beli consumer should do weldi sary in assembly of his in his own shop, with the sending the castings ready ing. With the aid of lante he discussed work in his o particularly with respect ing and use of fabricated thought that tests by gam and x-rays were most us "only as servants, not ma

Use of fabricated metal ing at the expense of cast cording to J. C. Pendleton, News Shipbuilding & Dry D Newport News, Va., givin opinion that the No. 1 pr to regain this lost ground. lines inroads have been che he believed the general re is adverse. Closer study o in co-operation with the c is needed, he said. By lante he illustrated various op particularly in marine casti pressure work, for which h mended virgin metal in all thought the importance of phy often over-emphasized tomers though he appreci importance of such test various circumstances.

John Howe Hall, consulti neer, Philadelphia, preside morning technical session Tour, Lucius Pitkin Inc., N at the afternoon session.

"HERCULES" RED-STRAND REG. U. S. PAT. OFF. WIRE ROPE

Furnished in Flattened Strand, Round Strand, Preformed, Steel Clad and Non-Rotating constructions.



A GIANT in Strength and Endurance

MADE ONLY BY
A. Leschen & Sons Rope Co.
ESTABLISHED 1857
5909 KENNERLY AVENUE
ST. LOUIS, MO.

NEW YORK
CHICAGO
DENVER
SAN FRANCISCO
PORTLAND
SEATTLE

Demand Slumps As Sentiment Wavers

Steelmaking Continues To Dip; Structural Outlook Good

MARKET IN TABLOID ★

Demand
Quieter for most products.

Prices
Steady and unchanged.

Production
Off 1 point to 53½ per cent.

TIMENT has been impaired by recent business ternational developments, with a quieting effect markets.

etdown in steel demand so far has been less ould be suggested by softening in security and by pessimism attributed to uncertainty e European outlook. Nevertheless, the past rend was more definitely downward and, com- the heels of a disappointing March, provides pectation of an immediate about-face in or- d production. Steelmaking the past week was oint to 53½ per cent, compared with 32 per ear ago.

ts of a lagging retail market for automobiles confirmation in assemblies last week, produc- reasing about 1000 units to 87,019. While Motors' output declined slightly to 32,735, s steady at 22,230, Chrysler increased a trifle 5 and all other makers boosted their total from o 11,529.

e same time, curtailment in releases of parts the downward revision in previous estimates future operations. Handicapped by three fewer days, April appears likely to show a falling otorcar assemblies compared with March, con- the common seasonal trend.

tion that not all interests will curtail pro- developed Friday with word that Dodge has d April schedules by 9800 units and will parts and materials accordingly. This may be erunner of a more general upswing within few weeks.

In Structurals, te Bars Sustained

test spot in steel demand is sustained activity tural shapes and concrete reinforcing bars. A nnage required for public works remains to ped, assuring a maintenance of production this quarter. Outstanding in prospective en- g projects is the 100,000-ton, Battery Park- n bridge at New York. Armament and pri- pbuilding work also promise maintained con- n of heavy products.

on among consumers is evident in the letdown in new business, but since buying for some time has been for only early needs, users will be unable to remain out of the market for an extended period. The East, most susceptible to European and stock market influences, shows the largest shrinkage in steel bookings, while the more westerly districts are inclined to emphasize domestic conditions as responsible for the less favorable situation.

Railroad orders for equipment and steel products continue restricted. Several thousand tons of rails were booked the past week, and a few additional roads are expected in the market later, but freight car orders are materializing slower than was hoped for.

Freight Car Awards Lag But Well Ahead of 1938

Freight car awards the first three months this year totaled 3062, compared with 814 a year ago, 30,933 two years ago and 9582 the first quarter of 1936. Merchants Dispatch Inc. will build 200 seventy-ton cement cars in its own shops.

Steel ingot production in March was the largest since last November and 67.5 per cent ahead of a year ago. First quarter output of 9,506,594 tons was not quite half-way between the 5,448,896 tons of the 1938 period and the 14,351,451 tons produced the corresponding months of 1937. Reflecting the increases in steelmaking capacity the past ten years, March operations of 55.63 per cent represented 65 per cent of 1929 capacity.

Smaller districts were responsible for most of last week's shrinkage in ingot output. Pittsburgh was unchanged at 49 per cent and Chicago held at 53½. Operations also were steady at 40 per cent in eastern Pennsylvania, 66 at Wheeling, 52½ at Cleveland and 62 at Birmingham. Buffalo increased 2½ points to 44½.

Reductions included 15 points to 35 per cent in New England, 7 points to 44 per cent at Cincinnati, 5 points to 69 at Detroit, 2 points to 48 at Youngstown and 1 point to 42 at St. Louis.

An easier tone prevails in nearly all scrap markets, but prices are nominally unchanged in principal centers and the scrap composite holds at $15.04. The finished steel composite also is unchanged at $56.50.

COMPOSITE MARKET AVERAGES

	Apr. 8	Apr. 1	Mar. 25	One Month Ago Mar., 1939	Three Months Ago Jan., 1939	One Year Ago Apr., 1938	Y
Iron and Steel	$36.40	$36.42	$36.42	$36.40	$36.36	$38.61	
Finished Steel	56.50	56.50	56.50	56.50	56.50	61.70	
Steelworks Scrap..	15.04	15.04	15.04	14.98	14.77	12.30	

Iron and Steel Composite:—Pig iron, scrap, billets, sheet bars, wire rods, tin plate, wire, sheets, plates, shapes, b pipe, rails, alloy steel, hot strip, and cast iron pipe at representative centers. Finished Steel Composite:—Plates, sha hot strip, nails, tin plate, pipe. Steelworks Scrap Composite:—Heavy melting steel and compressed sheets.

COMPARISON OF PRICES

Representative Market Figures for Current Week; Average for Last Month, Three Months and One Y

Finished Material

	April 8, 1939	March 1939	Jan. 1939	April 1938
Steel bars, Pittsburgh	2.25c	2.25c	2.25c	2.45c
Steel bars, Chicago	2.25	2.25	2.25	2.50
Steel bars, Philadelphia	2.57	2.57	2.57	2.765
Iron bars, Terre Haute, Ind.	2.15	2.15	2.15	2.35
Shapes, Pittsburgh	2.10	2.10	2.10	2.25
Shapes, Philadelphia	2.215	2.215	2.215	2.465
Shapes, Chicago	2.10	2.10	2.10	2.30
Plates, Pittsburgh	2.10	2.10	2.10	2.25
Plates, Philadelphia	2.15	2.15	2.15	2.445
Plates, Chicago	2.10	2.10	2.10	2.30
Sheets, hot-rolled, Pittsburgh	2.15	2.15	2.15	2.40
Sheets, cold-rolled, Pittsburgh	3.20	3.20	3.20	3.45
Sheets, No. 24, galv., Pittsburgh	3.50	3.50	3.50	3.80
Sheets, hot-rolled, Gary	2.15	2.15	2.15	2.50
Sheets, cold-rolled, Gary	3.20	3.20	3.20	3.25
Sheets, No. 24, galv., Gary	3.50	3.50	3.50	3.90
Bright bess., basic wire, Pitts.	2.60	2.60	2.60	2.90
Tin plate, per base box, Pitts.	$5.00	$5.00	$5.00	$5.35
Wire nails, Pittsburgh	2.45	2.45	2.45	2.75

Semifinished Material

Sheet bars, Pittsburgh, Chicago	$34.00	$34.00	$34.00	$37.00
Slabs, Pittsburgh, Chicago	34.00	34.00	34.00	37.00
Rerolling billets, Pittsburgh	34.00	34.00	34.00	37.00
Wire rods, No. 5 to $\frac{9}{32}$-inch, Pitts.	43.00	43.00	43.00	47.00

Pig Iron

	April 8, 1939	March 1939	Jan 193
Bessemer, del. Pittsburgh	$22.34	$22.34	$22.3
Basic, Valley	20.50	20.50	20.5
Basic, eastern, del. Philadelphia	22.34	22.34	22.3
No. 2 foundry, Pittsburgh	22.21	22.21	22.2
No. 2 foundry, Chicago	21.00	21.00	21.0
Southern No. 2, Birmingham	17.38	17.38	17.3
Southern No. 2, del. Cincinnati	20.89	20.89	20.8
No. 2X, del. Phila. (differ. av.)	23.215	23.215	23.2
Malleable, Valley	21.00	21.00	21.0
Malleable, Chicago	21.00	21.00	21.0
Lake Sup., charcoal, del. Chicago	28.34	28.34	28.3
Gray forge, del. Pittsburgh	21.17	21.17	21.1
Ferromanganese, del. Pittsburgh	85.33	85.27	90.2

Scrap

Heavy melting steel, Pittsburgh	$15.75	$15.75	$15
Heavy melt. steel, No. 2, E. Pa.	13.75	13.375	13.
Heavy melting steel, Chicago	14.25	14.25	13.
Rails for rolling, Chicago	17.25	17.25	17
Railroad steel specialties, Chicago	16.25	16.25	16

Coke

Connellsville, furnace, ovens	$ 3.75	$3.75	$3
Connellsville, foundry, ovens	5.00	5.00	5
Chicago, by-product fdry., del.	10.50	10.50	10

STEEL, IRON, RAW MATERIAL, FUEL AND METALS PRICES

Except when otherwise designated, prices are base, f.o.b. cars.

Sheet Steel

Hot Rolled

Pittsburgh	2.15c
Chicago, Gary	2.15c
Cleveland	2.15c
Detroit, del.	2.25c
Buffalo	2.15c
Sparrows Point, Md.	2.15c
New York, del.	2.39c
Philadelphia, del.	2.32c
Granite City, Ill.	2.25c
Middletown, O.	2.15c
Youngstown, O.	2.15c
Birmingham	2.15c
Pacific Coast points	2.65c

Cold Rolled

Pittsburgh	3.20c
Chicago, Gary	3.20c
Buffalo	3.20c
Cleveland	3.20c
Detroit, delivered	3.30c
Philadelphia, del.	3.52c
New York, del.	3.54c
Granite City, Ill.	3.30c
Middletown, O.	3.20c
Youngstown, O.	3.20c
Pacific Coast points	3.80c

Galvanized No. 24

Pittsburgh	3.50c
Chicago, Gary	3.50c
Buffalo	3.50c
Sparrows Point, Md.	3.50c
Philadelphia, del.	3.67c
New York, delivered	3.74c
Birmingham	3.50c
Granite City, Ill.	3.60c
Middletown, O.	3.50c
Youngstown, O.	3.50c
Pacific Coast points	4.00c

Black Plate, No. 29 and Lighter

Pittsburgh	3.05c
Chicago, Gary	3.05c
Granite City, Ill.	3.15c

Long Ternes No. 24 Unassorted

Pittsburgh, Gary	3.95c
Pacific Coast	4.65c

Enameling Sheets

	No. 10	No. 20
Pittsburgh	2.75c	3.35c
Chicago, Gary	2.75c	3.35c
Granite City, Ill.	2.85c	3.45c
Youngstown, O.	2.75c	3.35c
Cleveland	2.75c	3.35c
Middletown, O.	2.75c	3.35c
Pacific Coast	3.35c	3.95c

Corrosion and Heat-Resistant Alloys

Pittsburgh base, cents per lb.

Chrome-Nickel

	No. 302	No. 304
Bars	24.00	25.00
Plates	27.00	29.00
Sheets	34.00	36.00
Hot strip	21.50	23.50
Cold strip	28.00	30.00

Straight Chromes

	No. 410	No. 430	No. 442	No. 446
Bars	18.50	19.00	22.50	27.50
Plates	21.50	22.00	25.50	30.50
Sheets	26.50	29.00	32.50	36.50
Hot strip	17.00	17.50	23.00	28.00
Cold stp.	22.00	22.50	28.50	36.50

Steel Plate

Pittsburgh	2.10c
New York, del.	2.29c
Philadelphia, del.	2.15c
Boston, delivered	2.42c
Buffalo, delivered	2.33c
Chicago or Gary	2.10c
Cleveland	2.10c
Birmingham	2.10c
Coatesville, base	2.10c
Sparrows Point, base	2.10c
Claymont, del.	2.10c
Youngstown	2.10c
Gulf ports	2.45c
Pacific Coast points	2.60c

Steel Floor Plates

Chicago	3.35c
Gulf ports	3.70c
Pacific Coast ports	3.95c
Pittsburgh	3.35c

Standard Shapes

Pittsburgh	2.10c
Philadelphia, del.	2.21½c
New York, del.	2.27c
Boston, delivered	2.41c
Bethlehem	2.10c
Chicago	2.10c
Cleveland, del.	2.30c
Buffalo	
Gulf ports	
Birmingham	
St. Louis, del.	
Pacific Coast points	

Tin and Terne

Tin Plate, Coke (ba

Pittsburgh, Gary, Chic	
Granite City, Ill.	

Mfg. Terne Plate (ba

Pittsburgh, Gary, Chic	
Granite City, Ill.	

Bars

Soft Steel

(Base, 3 to 25 to

Pittsburgh	
Chicago or Gary	
Duluth	
Birmingham	
Cleveland	
Buffalo	
Detroit, delivered	
Philadelphia, del.	
Boston, delivered	
New York, del.	
Gulf ports	
Pacific Coast points	

Rail Steel

To Manufacturing

Pittsburgh	
Chicago or Gary	
Detroit, delivered	
Cleveland	

.....	2.10c
am	2.10c
ts	2.45c
ast points	2.70c

Iron

Terre Haute...	2.15c
hia	2.47c
h, refined...	3.50-8.00c

Reinforcing

let, straight lengths, ed by distributors

Gary, Buffalo	
Birm., Young.,	
vs Pt., Pitts....	2.05c
delivered	2.15c
s	2.40c
ast ports.....	2.50c
hia, del.	2.22c

eel, straight lengths, ed by distributors

h, Gary, Chi-	
Buffalo, Cleve-	
Birmingham....	1.90c
delivered	2.00c
s	2.25c
ast	2.35c

Products

ve.-Chicago-Birm. base lb. keg in carloads

wire nails	$2.45
oated nails	$2.45

(Per pound)

staples	3.15c
ce staples	3.40c
bed wire, stand-	
2½ gage two-	
log, 80-rod spool	
two-point cattle,	
spoci.....	$2.62
fence wire....	2.95c
ce wire.....	3.35c
ire fencing (base	
column)	67.00
loop bale ties,	
L. column)...	56.00

anufacturing Trade

ts. - Cleve. - Chicago- gham (except spring wire)

ss., basic wire..	2.60c
ed wire	2.65c
ire	3.20c

r, Mass., $2 higher on basic and spring wire. is, C. L. Pitts. lisc. on all extras) $3.60

Finished Bars

	Carbon	Alloy
gh	2.70c	3.40c
.....	2.70c	3.40c
d.	2.70c	3.40c
.....	2.75c	*3.50c
d	2.70c	3.40c
.....	2.70c	3.40c

ered.

Bars (Hot)

ase, 3 to 25 tons)

gh, Buffalo, Chi-	
Massillon, Can-	
ethlehem	2.80c
delivered	2.90c

Alloy	Diff.	S.A.E.	Alloy Diff.
	0.35	3100	0.70
	0.75	3200	1.35
	1.55	3300	3.80
	2.25	3400	3.20

5 to 0.25 Mo..... 0.55
) to 0.30 Mo. 1.50-
ft. 1.10
)-1.10 Cr. 0.45
spring flats 0.15
s 1.20
ing flats 0.85
Van. 1.50
Van. 0.85
ing flats 0.15
ng rounds, squares 0.40
tic furnace up 50 cents.

hgo., Buffalo.... 2.40c
ts 2.75c

Strip and Hoops

(Base, hot-rolled, 1 to 25 tons; cold-rolled, 3 to 25 tons)

Hot Strip, 12-inch and less

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, Birmingham....	2.15c
Detroit, del.	2.25c
Philadelphia, del.	2.47c
New York, del.	2.51c
Cooperage hoop, Youngs., Pitts., Chicago, Birm...	2.25c
Cold strip, 0.25 carbon and under, Pittsburgh, Cleveland, Youngstown	2.95c
Chicago	3.05c
Detroit, del.	3.05c
Worcester, Mass.	3.15c

Carbon	Cleve. Pitts.
0.26—0.50.....	2.95c
0.51—0.75.....	4.30c
0.76—1.00.....	6.15c
Over 1.00.....	8.35c

Worcester, Mass $4 higher.

Commodity Cold-Rolled Strip

Pitts.-Cleve.-Youngstown	3.10c
Detroit, del.	3.20c
Worcester, Mass.	3.50c

Lamp stock up 10 cents.

Rails, Fastenings

(Gross Tons)

Standard rails, mill.....	$40.00
Relay rails, Pittsburgh 20—100 lbs. 32.50-35.50	
Light rails, billet qual., Pitts., Chicago, B'ham.	$40.00
Do., rerolling quality..	39.00

Cents per pound

Angle bars, billet, mills.	2.70c
Do., axle steel	2.35c
Spikes, R. R. base	3.00c
Track bolts, base	4.15c
Car axles forged, Pitts., Chicago, Birmingham.	3.15c
Tie plates, base	2.15c

Base, light rails 25 to 60 lbs., 20 lbs., up $2; 16 lbs. up $4; 12 lbs. up $8; 8 lbs. up $10. Base railroad spikes 200 kegs or more; base plates 20 tons.

Bolts and Nuts

Pittsburgh, Cleveland, Birmingham, Chicago. Discounts to legitimate trade as per Dec. 1, 1932, lists, carloads 5% up; full containers additional 10%.

Carriage and Machine

½ x 6 and smaller.....68.5 off	
Do. larger, to 1-in.....66 off	
Do. 1⅛ and larger.....64 off	
Tire bolts .....52.5 off	

Stove Bolts

In packages with nuts attached 72.5 off; in packages with nuts separate 72.5-12½ off; bulk 84 off on 15,000 of 3-inch and shorter, or 5000 over 3-in.

Step bolts .....60 off	
Elevator bolts .....60 off	
Plow bolts .....68.5 off	

Nuts

Semifinished hex.	U.S.S.	S.A.E.
6-inch and less..	67	70
⅞—1-inch	64	65
1⅛ and larger..	62	62

Hexagon Cap Screws

Upset, 1-in., smaller.....67.5 off

Square Head Set Screws

Upset, 1-in., smaller.....75.0 off	
Headless set screws.....70.0 off	

Rivets, Washers

Structural, Pittsburgh, Cleveland, Chicago ...	3.40c
⅞-inch and smaller, Pitts., Chi., Cleve.....65-10 off	
Wrought washers, Pitts., Chi., Phila., to jobbers and large nut, bolt mfrs. l.c.l. $5.40; c.l. $5.75 off	

Welded Iron, Steel Pipe

Base discounts on steel pipe. Pitts., Lorain, O., to consumers in carloads. Gary, Ind., 2 points less on lap weld, 1 point less on butt weld. Chicago delivery 2½ and 1½ less, respectively. Wrought pipe, Pittsburgh base.

Butt Weld

Steel

In.	Blk.	Galv.
⅛	63½	54
¼	66½	58
⅜—⅜	68½	60½

Iron

¼	30	13
⅜—1¼	34	19
1½	38	21½
2	37½	21

Lap Weld

Steel

2	61	52½
2½—3	64	55½
3½—6	66	57½
7 and 8	65	55½
9 and 10	64½	55
11 and 12	63½	54

Iron

2	30½	15
2½—3½	31½	17½
4	33½	21
4½—8	32½	20
9—12	28½	15

Line Pipe

Steel

1 to 3, butt weld	67½
2, lap weld	60
2½ to 3, lap weld	63
3½ to 6, lap weld	65
7 and 8, lap weld	64
10-inch lap weld	63½
12-inch, lap weld	62½

Iron

	Blk.	Galv.
¾ butt weld	25	7
1 and 1¼ butt weld	29	13
1½ butt weld	33	15½
2 butt weld	32½	15
1½ lap weld	23½	7
2 lap weld	25½	9
2½ to 3½ lap weld	26½	11½
4 lap weld	28½	15
4½ to 8 lap weld..	27½	14
9 to 12 lap weld...	23½	9

Boiler Tubes

Carloads minimum wall seamless steel boiler tubes, cut lengths 4 to 24 feet; f.o.b. Pittsburgh, base price per 100 feet subject to usual extras.

Lap Welded

Sizes	Gage	Steel	Charcoal Iron
1½" O. D.	13	$ 9.72	$23.71
1¾" O. D.	13	11.06	22.93
2" O. D.	13	12.38	19.35
2¼" O. D.	13	13.79	21.68
2¼" O. D.	12	15.16	.....
2½" O. D.	12	16.58	26.57
2¾" O. D.	12	17.54	29.00
3" O. D.	12	18.35	31.36
3½" O. D.	11	23.15	39.81
4" O. D.	10	28.66	49.90
5" O. D.	9	44.25	73.93
6" O. D.	7	68.14	.....

Seamless

Sizes	Gage	Hot Rolled	Cold Drawn
1" O. D.	13	$ 7.82	$ 9.01
1¼" O. D.	13	9.26	10.67
1½" O. D.	13	10.23	11.79
1¾" O. D.	13	11.64	13.42
2" O. D.	13	13.04	15.03
2¼" O. D.	13	14.54	16.76
2¼" O. D.	12	16.01	18.45
2½" O. D.	12	17.54	20.21
2¾" O. D.	12	18.59	21.42
3" O. D.	12	19.50	22.48
3½" O. D.	11	24.62	28.37
4" O. D.	10	30.54	35.20
4½" O. D.	10	37.35	43.04
5" O. D.	9	46.87	54.01
6" O. D.	7	71.96	82.93

Cast Iron Pipe

Class B Pipe—Per Net Ton

6-in., & over, Birm..	$42.00-43.00
4-in., Birmingham..	45.00-46.00
4-in., Chicago.....	53.80-54.80
6-in. & over, Chicago	50.80-51.80
6-in. & over, east fdy.	46.00
Do., 4-in.	49.00

Class A Pipe $3 over Class B
Stnd. fitgs., Birm., base $100.00

Semifinished Steel

Rerolling Billets, Slabs

(Gross Tons)

Pittsburgh, Chicago, Gary, Cleve., Buffalo, Young., Birm., Sparrows Point..	$34.00
Duluth (billets)	36.00
Detroit, delivered	36.00

Forging Quality Billets

6 x 6 to 9 x 9-in., base

Pitts., Chicago, Buffalo...	40.00
Duluth	42.00

Sheet Bars

Pitts., Cleveland, Young., Sparrows Point, Buffalo, Canton, Chicago..	34.00
Detroit, delivered	36.00

Wire Rods

Pitts., Cleveland, Chicago, Birmingham No. 5 to ⅝-inch incl.	43.00
Do., over ⅝ to 41/64-in. incl.	48.00

Worcester up $2; Galveston up $6; Pacific Coast up $9.

Skelp

Pitts., Chi., Young., Buff., Coatesville, Sparrows Pt.	1.90c

Coke

Price Per Net Ton

Beehive Ovens

Connellsville, fur...	$3.75
Connellsville, fdry..	4.75- 5.50
Connell. prem. fdry.	5.75- 6.25
New River fdry....	6.50- 6.75
Wise county fdry...	5.50- 5.75
Wise county fur....	4.50- 4.75

By-Product Foundry

Newark, N. J., del...	10.88-11.35
Chi., ov., outside del.	9.75
Chicago, del.	10.50
Milwaukee, ovens..	10.50
New England, del...	12.50
St. Louis, del.	11.00-11.50
Birmingham, ovens.	7.00
Indianapolis, del....	10.00
Cincinnati, del.....	9.75
Cleveland, del.....	10.30
Buffalo, del.	10.50
Detroit, del.	10.25
Philadelphia, del...	10.65

Coke By-Products

Spot, gal., freight allowed east of Omaha

Pure and 90% benzol...	16.00c
Toluol, two degree.....	22.00c
Solvent naphtha	26.00c
Industrial xylol	26.00c

Per lb. f.o.b. Frankford and St. Louis

Phenol (200 lb. drums)	16.25c
Do. (450 lbs.)	15.25c

Eastern Plants, per lb.

Naphthalene flakes, balls, bbls. to jobbers	5.75c
Per ton, bulk, f.o.b. port	
Sulphate of ammonia....$28.00	

Pig Iron

Delivered prices include switching charges only as noted. No. 2 foundry is 1.75-2.25 sil.; 25c diff. for each 0.25 sil. above 2.25 sil.; 50c diff. below 1.75 sil. Gross tons.

Basing Points:	No. 2 Fdry.	Malleable	Basic	Bessemer
Bethlehem, Pa.	$22.00	$22.50	$21.50	$23.00
Birdsboro, Pa.	22.00	22.50	21.50	23.00
Birmingham, Ala.‡	17.38	.....	16.38	22.00
Buffalo	21.00	21.50	20.00	22.00
Chicago	21.00	21.00	20.50	21.50
Cleveland	21.00	21.00	20.50	21.50
Detroit	21.00	21.00	20.50	21.50
Duluth	21.50	21.50	.....	22.00
Erie, Pa.	21.00	21.50	20.50	22.00
Everett, Mass.	22.00	22.50	21.50	23.00
Granite City, Ill.	21.00	21.00	20.50	21.50
Hamilton, O.	21.00	21.00	20.50	.....
Neville Island, Pa.	21.00	21.00	20.50	21.50
Provo, Utah	19.00	.....	.....	.....
Sharpsville, Pa.	21.00	21.00	20.50	21.50
Sparrow's Point, Md.	22.00	.....	21.50	.....
Swedeland, Pa.	22.00	22.50	21.50	23.00
Toledo, O.	21.00	21.00	20.50	21.50
Youngstown, O.	21.00	21.00	20.50	21.50

‡Subject to 38 cents deduction for 0.70 per cent phosphorus or higher.

Delivered from Basing Points:				
Akron, O., from Cleveland	22.39	22.39	21.89	22.89
Baltimore from Birmingham	22.78	.....	21.66	.....
Boston from Birmingham	22.12	.....	.....	.....
Boston from Everett, Mass.	22.50	23.00	22.00	23.50
Boston from Buffalo	22.50	23.00	22.00	23.50
Brooklyn, N. Y., from Bethlehem	24.50	25.00	.....	.....
Canton, O., from Cleveland	22.39	22.39	21.89	22.89
Chicago from Birminghom	†21.22	.....	.....	.....
Cincinnati from Hamilton, O.	21.24	22.11	21.61	.....
Cincinnati from Birmingham	21.06	.....	20.06	.....
Cleveland from Birmingham	21.32	.....	20.82	.....
Mansfield, O., from Toledo, O.	22.94	22.94	22.44	22.44
Milwaukee from Chicago	22.10	22.10	21.60	22.60
Muskegon, Mich., from Chicago, Toledo or Detroit	24.19	24.19	23.69	24.69
Newark, N. J., from Birmingham	23.15	.....	.....	.....
Newark, N. J., from Bethlehem	23.53	24.03	.....	.....
Philadelphia from Birmingham	22.46	.....	21.96	.....
Philadelphia from Swedeland, Pa.	22.84	23.34	22.34	.....
Pittsburgh district from Neville Island	Neville base, plus 69c, 84c, and $1.24 freight.			
Saginaw, Mich., from Detroit	23.45	23.45	22.95	22.95

	No. 2 Fdry.	Malleable	Ba
St. Louis, northern	21.50	21.50	2
St. Louis from Birmingham	†21.12	....	2
St. Paul from Duluth	23.63	23.63	

†Over 0.70 phos.

Low Phos.

Basing Points: Birdsboro and Steelton, Pa., and Stan $26.50, base; $27.74 delivered Philadelphia.

Gray Forge		**Charcoal**
Valley furnace	$20.50	Lake Superior fur.
Pitts. dist. fur.	20.50	do., del Chicago
		Lyles, Tenn.

†Silvery

Jackson county, O., base: 6-6.50 per cent $25.50; 6.51-7-7.50—$26.50; 7.51-8—$27.00; 8-8.50—$27.50; 8.51-9-9.50—$28.50; Buffalo, $1.25 higher.

Bessemer Ferrosilicon†

Jackson county, O., base; Prices are the same as fo plus $1 a ton.

†The lower all-rail delivered price from Jackson, O., is quoted with freight allowed.

Manganese differentials in silvery iron and ferrosilicon $1 per ton add. Each unit over 3%, add $1 per to

Refractories

Per 1000 *f.o.b. Works, Net Prices*

Fire Clay Brick

Super Quality

Pa., Mo., Ky.	$60.80

First Quality

Pa., Ill., Md., Mo., Ky.	47.50
Alabama, Georgia	47.50
New Jersey	52.50

Second Quality

Pa., Ill., Ky., Md., Mo.	42.75
Georgia, Alabama	34.20
New Jersey	49.00

Ohio

First quality	39.90
Intermediate	36.10
Second quality	31.35

Malleable Bung Brick

All bases	$56.05

Silica Brick

Pennsylvania	$47.50
Joliet, E. Chicago	55.10
Birmingham, Ala.	47.50

Ladle Brick

(Pa., O., W. Va., Mo.)

Dry press	$28.00
Wire cut	$26.00

Magnesite

Imported dead - bu grains, net ton f Chester, Pa., and timore bases (bag

Do. domestic

Do., f.o.b. Chewe

Wash., net ton, bul net ton, bags

Quickset magnes grains, f.o.b. Che lah, Wash., net bulk

Basic Brick

Net ton, f.o.b. Balti mouth Meeting, Ch

Chrome brick

Chem. bonded chrome

Magnesite brick

Chem. bonded magne

Fluorspar, 85-

Washed gravel, paid, tide, net ton

Washed gravel, f.o.b. Ky., net ton, carlo all rail $17, barge

No. 2 lump

Ferroalloy Prices

Ferromanganese, 78-82%, tidewater, duty pd. $80.00

Do., del. Pittsburgh 85.33

Spiegeleisen, 19-21% dom. Palmerton, Pa., spot 28.00

Do., 26-28%, Palmerton 33.00

Ferrosilicon, 50% freight allowed, c.l. 69.50

Do., ton lot 80.50

Do., 75 per cent 126.00

Spot, $5 a ton higher.

Silicoman, 2½ carbon 88.00

2% carbon, 93.00; 1%, 103.00

Contract ton price $11 higher; spot $5 over contract.

Ferrotungsten, stand., lb. con. del. cars 1.65-1.70

Ferrovanadium, 35 to 40%, lb., cont. 2.70-2.80-2.90

Ferrophosphorus, gr. ton, c.l., 17-18% Rockdale, Tenn., basis, 18%, $3 unitage, 58.50; electrolytic, per ton, c. l., 23-26% f.o.b. Monsanto, Tenn., 24% $3 unitage 75.00

Ferrochrome, 66-70 chromium, 4-6 carbon, cts. lb., contained cr., del. carlots 10.50c

Do., ton lots 11.25c

Do., less-ton lots 11.50c

67-72% carloads, 2% carbon, per lb. contained

chrome	16.50c
Do., ton lots	17.25c
Do., less-ton lots	17.75c

	Carloads	Ton lots	Less ton
2% carb.	16.50c	17.25c	17.50c
1% carb.	17.50c	18.25c	18.50c
0.10% carb.	18.50c	19.25c	19.50c
0.20% carb.	19.50c	20.25c	20.50c

Spot ¼c higher

Ferromolybdenum, 55-65% molyb. cont., f.o.b. mill, lb. 0.95

Calcium molybdate, lb. molyb. cont., f.o.b. mill 0.80

Ferrotitanium, 40-45%, lb., con. ti., f.o.b. Niagara Falls, ton lots $1.23

Do., less-ton lots 1.25

20-25% carbon, 0.10 max., ton lots, lb. 1.35

Do, less-ton lots 1.40

Spot 5c higher

Ferrocolumbium, 50-60%, contract, lb. con. col., f.o.b. Niagara Falls $2.25

Do, less-ton lots 2.30

Spot is 10c higher

Technical molybdenum trioxide, 53 to 60% molybdenum, lb. molyb. cont., f.o.b. mill 0.80

Ferro-carbon-titanium, 15-18%, ti., 6-8% carb., carlots, contr., net ton $142.50

Do, spot 145.00

Do, contract, ton lots 145.00

Do, spot, ton lots 150.00

15-18% ti., 3-5% carbon, carlots, contr., net ton 157.50

Do, spot 160.00

Do, contract, ton lots 160.00

Do, spot, ton lots 165.00

Alsifer, contract carlots, f.o.b. Niagara Falls, lb. 7.50c

Do, ton lots 8.00c

Do, less-ton lots 8.50c

Spot ½c lb. higher

Chromium Briquets, contract, any quantity, freight allowed, lb. 7.25c

Do, spot carlots, bulk 7.50c

Do, ton lots 8.00c

Do., less-ton lots 8.25c

Tungsten Metal Powder, according to grade, spot shipment, 200-lb. drum lots, lb. $2.05

Do, smaller lots 2.15

Vanadium Pentoxide, contract, lb. contained $1.10

Do, spot 1.15

Chromium Metal, 98% cr., 0.50 carbon max., contract, lb. con. chrome 80.00c

Do, spot 85.00c

88% chrome, contract 79.00c

Do, spot 84.00c

Silicon Metal, 1% iron, contract, carlots, 2 ⅛-in., lb.

Do, 2%

Spot ¼c high

Silicon Briquets, contr carloads freight lowed, ton

Carload, spot

Less-ton lots, lb.

Manganese Brique contract carloa bulk freight allow lb.

Ton lots

Less-ton lots

Spot ¼c high

Zirconium Alloy, 12-15 contract, carloa gross ton

Do, spot

34-40%, contract, c loads, lb., alloy

Do, ton lots

Do, less-ton lots

Spot ¼c high

Molybdenum Powd 99%, f.o.b. York, 200-lb. kegs, lb.

Do, 100-200 lb. lots

Do, under 100-lb. l

Molybdenum Oxi Briquets, 48-52% lybdenum, per pou contained, f.o.b. pr ducers' plant

WAREHOUSE STEEL PRICES

Base Prices in Cents Per Pound, Delivered Locally, Subject to Prevailing Differentials

	Soft Bars	Bands	Hoops	Plates ¼-in. & Over	Structural Shapes	Floor Plates	Sheets: Hot Rolled	Sheets: Cold Rolled	Sheets: Galv. No. 24
.....	3.98	4.21	5.21	3.85	3.85	5.66	3.86	4.93	4.61
(Metropolitan)...	3.94	4.11	4.11	3.76	3.75	5.56	3.40	4.60	4.50
la	3.60	3.60	4.10	3.40	3.40	5.00	3.40	....	4.33
.....	3.80	3.95	4.35	3.65	3.65	5.00	3.70	5.05	4.30
a.	4.00	4.15	....	3.85	3.85	5.20	3.90	....	5.40
.....	3.60	3.97	3.97	3.77	3.55	5.40	3.50	4.55	4.40
.....	3.60	3.75	3.75	3.55	3.55	5.15	3.50	4.60	4.50
.....	3.50	3.65	3.65	3.55	3.73	5.33	3.50	4.70	4.62
.....	3.43	3.58	3.83	3.75	3.80	5.42	3.58	4.65	4.74
.....	3.85	3.82	3.82	3.80	3.83	5.43	3.57	....	4.57
.....	3.60	3.75	3.75	3.55	3.55	5.15	3.50	4.45	4.50
s	3.85	4.00	4.00	3.80	3.80	5.40	3.75	5.10	4.75
.....	3.73	3.88	3.88	3.68	3.68	5.28	3.63	4.58	4.63
.....	3.72	3.87	3.87	3.47	3.47	5.07	3.53	4.47	4.53
y	4.15	4.30	4.30	4.10	4.10	5.70	4.10	....	4.75
.....	4.00	4.15	4.15	3.95	3.95	5.71	3.90	....	5.25
ga	3.90	4.05	4.05	3.85	3.85	5.80	3.80	....	4.40
a.	4.64	4.79	4.79	4.59	4.59	6.19	4.54	....	5.54
m, Ala.	3.50	3.65	3.65	3.45	3.45	5.83	3.40	....	4.75
ns	3.85	4.65	4.65	3.80	3.80	5.75	4.10	....	4.60
Tex.	3.50	5.85	6.25	4.05	4.05	5.65	3.95	....	5.25
.....	4.30	4.50	5.85	4.05	4.15	5.90	3.95	....	5.25
Oreg.	4.00	4.40	6.10	4.00	4.00	5.50	3.95	6.50	4.75
es	4.00	4.50	6.35	4.00	4.00	6.20	4.20	6.30	4.75
sco	3.65	4.05	6.00	3.60	3.60	5.20	3.60	6.40	5.15

	Cold Rolled Strip	Cold Finished Bars	SAE Hot-rolled Bars (Unannealed): 1035-1050	2300 Series	3100 Series	4100 Series	6100 Series	SAE Cold Drawn Bars: 2300	3100
.....	3.61	4.18	4.28	7.65	6.25	6.00	8.05	8.73	7.33
.....	3.66	4.14	4.14	7.50	6.10	5.85	....	8.69	7.29
la	3.66	4.11	3.85	7.46	6.06	5.81	8.71	....	....
.....	....	4.10	3.95	....	....	....	....	....	....
a.	....	4.20	....	....	....	....	....	....	....
.....	3.57	3.80	3.80	7.25	5.85	5.60	7.65	8.25	6.85
.....	3.35	3.70	3.80	7.35	5.95	5.70	7.75	8.35	6.95
.....	3.35	3.80	3.70	7.45	6.05	6.05	7.85	8.25	6.85
.....	3.55	3.85	3.58	7.57	6.17	5.92	7.39	8.55	7.15
.....	3.60	4.05	3.90	7.59	6.19	5.94	8.99	8.60	7.20
.....	3.65	3.80	3.80	7.25	5.85	5.60	7.65	8.25	6.85
s	....	4.39	4.00	7.60	6.20	8.79	9.34	8.94	7.54
.....	....	3.93	3.93	7.48	6.08	5.83	7.88	8.48	7.08
.....	3.76	4.07	3.92	7.62	6.22	5.97	8.02	8.62	7.22
y	4.46	4.60	....	....	....	....	....	....	....
.....	....	4.61	....	....	....	....	....	....	....
ga	....	4.44	....	....	....	....	....	....	....
a	....	4.84	....	....	....	....	....	....	....
m, Ala.	....	4.73	....	....	....	....	....	....	....
ns	5.00	5.10	....	....	....	....	....	....	....
.....	....	5.60	5.65	....	7.80	7.65	8.45	....	....
Oreg.	....	5.60	6.10	9.00	8.00	7.85	8.70	....	....
es	4.45	6.00	4.65	9.40	8.55	8.40	9.05	10.40	9.55
isco	*9.30	6.55	5.20	9.65	8.80	8.65	9.30	10.65	9.80

*c on minimum quantity.

CURRENT IRON AND STEEL PRICES OF EUROPE

Dollars at Rates of Exchange, April 6

Prices f. o. b. Port of Dispatch—

By Cable or Radio

	British gross tons U. K. ports £ s d	Quoted in dollars at current value	Continental Channe or North Sea ports, gross tons **Quoted in gold pounds sterling £ s d
-3.00 Si...	$23.45 5 0 0	$17.25	2 0 6
r.	.....	16.40	1 18 6
os. .03-.05	26.97 5 15 0*	.....	.....
.....	$34.59 7 7 6	$38.34	4 10 0
. 5 gage..	53.35 11 7 6	42.60	5 0 0
.....	$44.56 9 10 0	$48.99	5 15 0
a.....	2.30c 11 0 0	1.85c to 1.95c	4 15 0 to 5 0 0
pes.....	2.09c 10 0 0	1.85c to 1.90c	4 15 0 to 4 17 6
. or 5 mm.	2.29c 10 18 9	2.10c to 2.34c	5 7 6 to 6 0 0
, 24 gage			
.....	2.72c 13 0 0	2.93c	7 10 0*
4 ga., corr.	3.29c 15 15 0	3.61c	9 5 0
rips.....	2.77c 13 5 0	1.95c	5 0 0
sc.....	4.08c 19 10 0	2.39c to 2.83c	6 2 6 to 7 5 0
ire, base..	4.86c 23 5 0	3.07c to 3.17c	7 17 6 to 8 2 6
ase.....	.....	2.73c to 2.93c	7 0 0 to 7 10 0
x 108 lbs.	$ 4.73 1 0 3	.....	.....

manganese $80.00 delivered Atlantic seaboard duty-paid.

Domestic Prices at Works or Furnace—

Last Reported

	£ s d	French Francs		Belgian Francs		Reich Mark
Fdy. pig iron, Si. 2.5.	$23.22 4 19 0(a)	$17.44	620.50	$15.17	450	$25.28 63
Basic bess. pig iron..	21.69 4 12 6(a)	.....	...	.....	...	27.88(b) 69.50
Furnace coke.....	5.39 1 4 2	5.96	225	7.25	215	7.62 19
Billets.....	34.59 7 7 6	25.04	945	28.98	860	38.72 96.50
Standard rails.....	1.99c 9 10 0	1.56c	1,300	2.06c	1,375	2.38c 132
Merchant bars.....	2.42c 11 12 0††	1.44c	1,202	1.65c	1,100	1.98c 110
Structural shapes...	2.17c 10 8 0††	1.41c	1,173	1.65c	1,100	1.93c 107
Plates, †¼-in. or 5 mm.....	2.29c 10 19 3††	1.82c	1,515	2.06c	1,375	2.29c 127
Sheets, black.....	3.08c 14 15 0§	2.17c	1,805‡	2.36c	1,575‡	2.59c 144‡
Sheets, galv., corr., 24 ga. or 0.5 mm.....	3.61c 17 5 0	3.30c	2,750	4.13c	2,750	6.66c 370
Plain wire.....	4.08c 19 10 0	1.92c	1,600	2.48c	1,650	3.11c 173
Bands and strips...	2.58c 12 7 0††	1.71c	1,340	1.95c	1,300	2.29c 127

*Basic. †British ship-plates. Continental, bridge plates. §24 ga. ‡1 to 3 mm. basic price. British quotations are for basic open-hearth steel. Continent usually for basic-bessemer steel. (a) del. Middlesbrough. 5s rebate to approved customers. (b) hematite. °Close annealed. ††Rebate of 15s on certain conditions.

**Gold pound sterling carries a premium of 75 per cent over paper sterling.

IRON AND STEEL SCRAP PRICES

Corrected to Friday night. Gross tons delivered to consumers, except where otherwise stated; †indicates brokers

HEAVY MELTING STEEL

Birmingham, No. 1	†12.00
Bos. dock No. 1 exp.	13.75-14.00
New Eng. del. No. 1	14.00
Buffalo, No. 1	13.75-14.25
Buffalo, No. 2	12.00-12.50
Chicago, No. 1	14.00-14.50
Chicago, auto, no alloy	12.50-13.00
Chicago, No. 2 auto	11.50-12.00
Cincinnati, dealers	11.50-12.00
Cleveland, No. 1	14.50-15.00
Cleveland, No. 2	13.50-14.00
Detroit, No. 1	10.50-11.00
Detroit, No. 2	9.00- 9.50
Detroit (industrial)	11.00-11.50
Eastern Pa., No. 1	15.50-16.00
Eastern Pa., No. 2	13.50-14.00
Federal, Ill.	11.75-12.25
Granite City, R. R.	12.00-12.50
Granite City, No. 2	11.00-11.50
Los Angeles, No. 1	12.50-13.50
Los Angeles, No. 2	11.00-11.50
N. Y. dock No. 1 exp.	12.00-12.50
Pitts., No. 1 (R. R.)	16.25-16.75
Pittsburgh, No. 1	15.50-16.00
Pittsburgh, No. 2	14.50-15.00
St. Louis, R. R.	12.25-12.75
St. Louis, No. 2	11.00-11.50
San Francisco, No. 1	12.00
Seattle, No. 1	12.00
Toronto, dlrs. No. 1	9.50- 9.75
Valleys, No. 1	15.00-15.50

COMPRESSED SHEETS

Buffalo	12.00-12.50
Chicago, factory	13.00-13.50
Chicago, dealer	12.00-12.50
Cincinnati, dealers	10.75-11.25
Cleveland	14.50-15.00
Detroit	11.50-12.00
E. Pa., new mat.	15.50
E. Pa., old mat.	11.00-11.50
Los Angeles	12.50-13.00
Pittsburgh	15.50-16.00
St. Louis	10.00-10.50
Valleys	14.50-15.00

BUNDLED SHEETS

Buffalo, No. 1	12.00-12.50
Buffalo, No. 2	11.00-11.50
Cleveland	11.00-11.50
Los Angeles	14.00
Pittsburgh	14.75-15.25
St. Louis	7.00- 7.50
Toronto, dealers	3.50

SHEET CLIPPINGS, LOOSE

Chicago	8.50- 9.00
Cincinnati, dealers	6.75- 7.25
Detroit	8.75- 9.25
†Los Angeles	3.75- 4.00
St. Louis	6.00- 6.50

BUSHELING

Buffalo, No. 1	12.00-12.50
Chicago, No. 1	12.50-13.00
Cincin., No. 1, deal.	8.25- 8.75
Cincinnati, No. 2	3.75- 4.25
Cleveland, No. 2	8.50- 9.00
Detroit, No. 1, new	10.50-11.00
Valleys, new, No. 1	14.25-14.75
Toronto, dealers	4.00- 4.25

MACHINE TURNINGS (Long)

Birmingham	†4.50- 5.00
Buffalo	7.00- 7.50
Chicago	7.00- 7.50
Cincinnati, dealers	4.75- 5.25
Cleveland	7.50- 8.00
Detroit	5.75- 6.25
Eastern Pa.	9.50-10.00
Los Angeles	4.50- 5.00
New York	†3.50- 4.00
Pittsburgh	9.75-10.25
St. Louis	3.00- 4.00
Toronto, dealers	4.00- 4.50
Valleys	9.50-10.00

SHOVELING TURNINGS

Buffalo	7.25- 8.00
Cleveland	8.00- 8.50
Chicago	8.50- 9.00
Detroit	6.50- 7.00
Pitts., alloy-free	11.25-11.75

BORINGS AND TURNINGS

For Blast Furnace Use

Boston district	2.00
Buffalo	7.00- 7.25
Cincinnati, dealers	3.25- 3.75
Cleveland	8.50- 9.00
Eastern Pa.	6.50- 7.00
Detroit	6.25- 6.75
New York	†2.50- 3.00
Pittsburgh	8.75- 9.00
Toronto, dealers	5.00- 5.50

AXLE TURNINGS

Boston district	†7.50
Buffalo	9.50-10.00
Chicago, elec. fur.	14.00-14.50
East. Pa., elec. fur.	13.50
St. Louis	9.50-10.00
Toronto	4.25- 4.50

CAST IRON BORINGS

Birmingham	†6.00- 6.50
Boston dist. chem.	†5.75- 6.00
Buffalo	7.50- 8.00
Chicago	5.50- 6.00
Cincinnati, dealers	3.25- 3.75
Cleveland	8.50- 9.00
Detroit	6.25- 6.75
E. Pa., chemical	10.00-11.00
New York	†3.50- 4.00
St. Louis	2.50- 3.00
Toronto, dealers	4.00- 4.25

RAILROAD SPECIALTIES

Chicago	16.00-16.50

ANGLE BARS—STEEL

Chicago	15.50-16.00
St. Louis	13.50-14.00

SPRINGS

Buffalo	16.00-16.50
Chicago, coil	16.50-17.00
Chicago, leaf	15.00-15.50
Eastern Pa.	17.50-18.00
Pittsburgh	18.00-18.50
St. Louis	15.00-15.50

STEEL RAILS, SHORT

Birmingham	†12.00-12.50
Buffalo	17.00-17.50
Chicago (3 ft.)	16.00-16.50
Chicago (2 ft.)	16.50-17.00
Cincinnati, dealers	16.50-17.00
Detroit	17.00-17.50
Los Angeles	15.00-15.50
Pitts., 3 ft. and less	18.25-18.75
St. Louis, 2 ft. & less	16.25-16.75

STEEL RAILS, SCRAP

Boston district	†13.50-14.00
Buffalo	16.00-16.50
Chicago	14.00-14.50
Cleveland	17.00-17.50
Pittsburgh	17.00-17.50
St. Louis	13.50-14.00
Seattle	16.00

FROGS, SWITCHES

Chicago	14.00-14.50
St. Louis, cut	13.50-14.00

ARCH BARS, TRANSOMS

St. Louis	14.00-14.50

PIPE AND FLUES

Chicago, net	9.00- 9.50
Cincinnati, dealers	7.00- 7.50

RAILROAD GRATE BARS

Buffalo	10.00-10.50
Chicago, net	8.50- 9.00
Cincinnati, dealers	7.00- 7.50
Eastern Pa.	13.50
New York	†8.50- 9.00
St. Louis	9.00- 9.50

RAILROAD WROUGHT

Birmingham	†11.00-11.50
Boston district	†9.50-10.00
Eastern Pa., No. 1	16.00-16.50
St. Louis, No. 1	10.25-10.75
St. Louis, No. 2	12.00-12.50

FORGE FLASHINGS

Boston district	†8.50
Buffalo	12.00-12.50
Cleveland	12.00-12.50
Detroit	10.25-10.75
Los Angeles	9.00
Pittsburgh	14.50-15.00

FORGE SCRAP

Boston district	†6.50
Chicago, heavy	16.50-17.00

LOW PHOSPHORUS

Buffalo, crops	16.50-17.00
Cleveland, crops	18.00-18.50
Eastern Pa., crops	17.00-17.50
Pitts., billet, bloom, slab crops	19.00-19.50

LOW PHOS. PUNCHINGS

Buffalo	15.50-16.00
Chicago	16.50-17.00
Eastern Pa., crops	17.50-18.00
Pittsburgh	17.50-18.00
Seattle	15.00

RAILS FOR ROLLING

5 feet and over

Birmingham	†14.00-15.00
Boston	15.00-15.50
Chicago	17.00-17.50
New York	†14.50-15.00
Eastern Pa.	17.00-17.50
St. Louis	16.00-16.50

STEEL CAR AXLES

Birmingham	†15.00-16.00
Buffalo	16.50-17.00
Boston district	†16.00-16.50
Chicago, net	18.00-18.50
Eastern Pa.	21.00-21.50
St. Louis	18.00-18.50

LOCOMOTIVE TIRES

Chicago (cut)	16.00-16.50
St. Louis, No. 1	13.50-14.00

SHAFTING

Boston district	†15.25-15.75
New York	
Eastern Pa.	
St. Louis, 1¼-3¾"	

CAR WHEELS

Birmingham	
Boston dist., iron	
Buffalo, steel	
Chicago, iron	
Chicago, rolled steel	
Cincin., iron, deal.	
Eastern Pa., iron	
Eastern Pa., steel	
Pittsburgh, iron	
Pittsburgh, steel	
St. Louis, iron	
St. Louis, steel	

NO. 1 CAST SCRAP

Birmingham	
Boston, No. 1 mach.	
N. Eng. del. No. 2	
N. Eng. del. textile	
Buffalo, cupola	
Buffalo, mach.	
Chicago, agri. net	
Chicago, auto net	
Chicago, rail'd net	
Chicago, mach. net	
Cincin., mach. deal.	
Cleveland, mach.	
Eastern Pa., cupola	
E. Pa., mixed yard	
Los Angeles, net	
Pittsburgh, cupola	
San Francisco, del.	
Seattle	
St. Louis, cupola	
St. Louis, agri. mach	
St. L., No. 1 mach.	
Toronto, No. 1, mach., net	

HEAVY CAST

Boston dist. break.	
New England, del.	
Buffalo, break.	
Cleveland, break, net	
Detroit, auto net	
Detroit, break.	
Eastern Pa.	
Los Ang., auto, net	
New York, break.	
Pittsburgh, break.	

STOVE PLATE

Birmingham	
Boston district	
Buffalo	
Chicago, net	
Cincinnati, dealers	
Detroit, net	
Eastern Pa.	
New York, fdy.	
St. Louis	
Toronto dealers, net	

MALLEABLE

Birmingham, R. R.	
New England, del.	
Buffalo	
Chicago, R. R.	
Cincin., agri., deal.	
Cleveland, rail	
Eastern Pa., R. R.	
Los Angeles	
Pittsburgh, rail	
St. Louis, R. R.	

Iron Ore

Lake Superior Ore

Gross ton, 51½%

Lower Lake Ports

Old range bessemer	$5.25
Mesabi nonbes.	4.95
High phosphorus	4.85
Mesabi bessemer	5.10
Old range nonbes.	5.10

Eastern Local Ore

Cents, unit, del. E. Pa.

Foundry and basic 56.63% con.	9.00-9.25
Cop.-free low phos. 58-60%	nominal

Foreign Ore

Cents per unit, c.i.f. Atlantic

Foreign manganiferous ore, 45.55% iron, 6-10% man. nom.	12.00
No. Afr. low phos.	12.00
Swedish low phos.	12.00
Spanish No. Africa basic, 50 to 60% nom.	9.00- 9.50
Tungsten. sh. ton. unit, duty pd. nom.	20.00
N. F., fdy., 55%	7.00
Chrome ore, 48% gross ton, c.i.f.	$23.00-24.00
Molybdenum ores sulphide, per lb.	molybdenum contained, f.o.b. mill

Manganese C

Prices not including per unit cargo

Caucasian, 50-52% nom.	
So. African, 50-52% nom.	
Indian, 49-50%	

ets, Strip

Strip Prices, Pages 86, 87

gh — Recovery in sheet buying from recently de- evels will be necessary to reduction in mill sched- oduction already has re- derately. Automotive de- been lighter than expect- ugh March tonnage re- to the January level and eady consumption is ex- uring April. Prices are ith galvanized quotations better than usual for this Galvanized sheet output is ower at 60 per cent, the ne so far this year. Other operations show only ange but the tendency is

nd—Less favorable pros- the automotive industry ced activity among parts- loud the outlook for flat- eel. Demand from miscel- consumers is fairly steady, hood is seen of some fall- total business this month, a fairly even trend in and March. Mill backlogs in the absence of forward

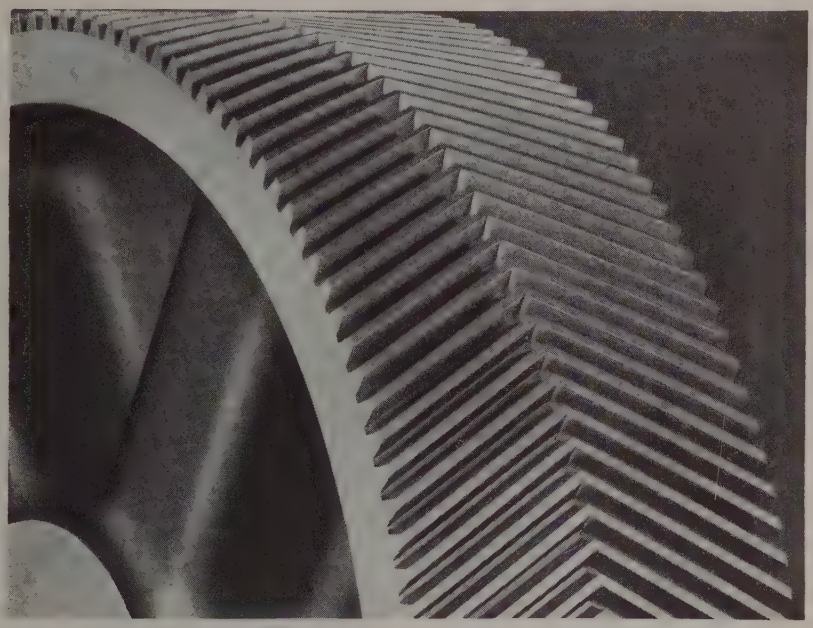
o—Sales have shown prac- change since the second f February. Automotive has slackened recently, al- replacement of stocks of rades has increased. While not offset the general lag otive sheet buying, volume bolstered by heavier busi- where, with some types of naking a better showing s expected. Heavy place- st fall still are deterring s somewhat.

—Lyons Iron Works, Man- N. H., has been awarded ap- ely 100 tons of hot-rolled, nd annealed sheets for 1940 mpshire license tag stock, rial to be produced by a ates Steel Corp. subsidiary. ed April 3. Except for a flurry in demand for num- material in several other mand is light, with jobbers heet orders in small lots for elivery. Incoming cold strip s barely maintained, with line in business from auto- arts makers. Rerollers have klogs, operations at around ent of capacity being sus- day-to-day orders.

ork—Most sheet deliveries old orders, with new buy- . Principal consumption is nfacturers of household t. These interests bought rather heavily earlier in the year and have ordered sparingly since then, but some important fill-in purchases are expected late this month. Fabricators of metal doors and door bucks are counted on to enter the market shortly for substantial tonnages, since stocks of some are understood to be low.

Demand for narrow cold strip has slackened in some directions with tonnage moving to the automotive industry smaller. Some fair volume has been done with producers of household appliances, but no steady or sustained demand is maintained. Cold finished operations are around 50 per cent with prompt delivery specified on most incoming volume. Mills have meager backlogs.

Philadelphia — Automotive sheet requirements are declining on a further drop in specifications from assembly plants. One frame maker has completed its run on 1939 models. However, one small car builder, which got under way slowly this year, has scheduled 3000 jobs for April, 3500 for May and



HORSBURGH & SCOTT OFFERS YOU *these features* IN HERRINGBONE GEARS

1. Quiet at all speeds. 2. All end thrust eliminated. 3. Overlapping action of the teeth eliminates shocks, resulting in long life. 4. The outside diameter, faces, bores and ends of the hubs are smoothly finished to the correct size. 5. The teeth are accurately generated with the correct amount of backlash for quiet, smooth operation. 6. The pitch line is absolutely concentric with the bore. 7. The rim and arms or web are extra heavy for the pitch of the gear.

Company Letterhead with your name brings you a Complete Catalog

THE HORSBURGH & SCOTT CO.

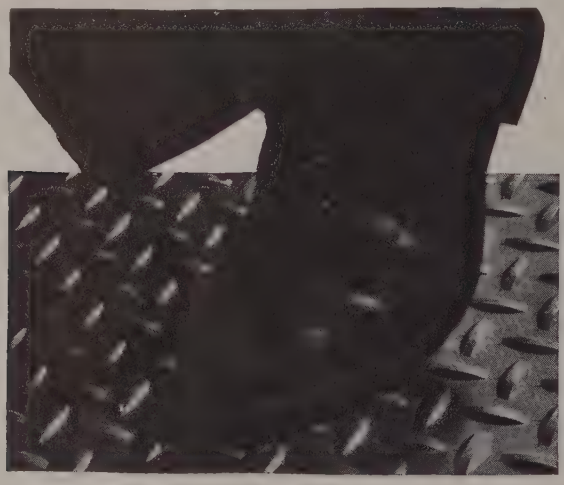
GEARS AND SPEED REDUCERS

5112 HAMILTON AVENUE, CLEVELAND, OHIO, U. S. A.

5000 for June. The Du Pont company will require nearly 300 tons of galvanized sheets for duct work in air-conditioning its new Seaford, Del., plant. A large tonnage also will be required for ventilating tunnels of the Pennsylvania turnpike. It is reported Russia will enter the market for an additional large tonnage of sheets and strip, since its own production is not up to expectations. Russia recently has been buying over 2000 tons monthly. Reduction in the Turkish tariff is not expected to aid sales immediately, because the country is short on dollar exchange.

Buffalo — Demand for sheets and strip is holding steady around recent levels but aggregate business is not coming up to expectations. Buying lacks snap and orders are being placed to fill immediate needs only. Demand is diversified with automotive specifications still limited.

Cincinnati — Seasonal improvement in sheet business has been below expectations. Demand for spiral welded pipe is heavier, while spotty gains are noted in galvanized sheets.



INLAND 4-WAY FLOOR PLATE FOR *Safety + Comfort*

Air circulating underneath the shoes, between the projections of Inland 4-Way Floor Plate has a cooling, restful effect on the feet.

Efficiency goes up—as the number of costly falls and accidents goes down. Traffic of men and materials starts easier, moves faster, stops quicker—with fewer slips.

Leading safety engineers endorse Inland 4-Way Floor Plate for floors, stairways, platforms. An attractive 16-page booklet tells the money-saving story of this common-sense product.

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INLAND STEEL CO.

38 SOUTH DEARBORN STREET, CHICAGO

Sheets • Strip • Tin Plate • Bars • Plates • Structurals • Piling • Rails • Reinforcing Bars

Other needs vary only sli... March specifications, wit... tive requirements disapp...

Birmingham, Ala. — ... holding close to the capa... Output, as it has been ... time, is fairly well divide... manufacturers' and roofi... Strip is not in great dema... although production h... stepped up somewhat in... tion of the forthcoming c... son.

Plates

Plate Prices, Page 8

New York—Plate busine... active than at any time s... year, with the tense polit... tion abroad a depressin... However, ship specificat... well sustained, with additi... ness from the navy and ... commission in prospect. T... will place contracts befor... three high-speed passeng... for Oriental service. Turl ... ing Works, this city, recen... as having been awarded ... sons for a bridge at Po... N. H., has withdrawn. ... Laughlin Steel Corp. wil... and fabricate this materia...

Boston — Award of 400 ... a standpipe, Framingham, ... outstanding. However, s... thousand tons are pending ... construction, including tu... Part of this tonnage will b... by a New York contractor ... a temporary Boston offic... yard releases continue ste... such tonnage is confined l... one eastern Pennsylvania ... the exception of specificati... navy yards which are mo... distributed. Miscellaneous ... is slack with shipments t... structural and railroad sho...

Philadelphia—Plate mak... disappointed over the vo... miscellaneous small-lot ... Ship plate releases are appe... lots of several hundred tons ... large tonnage has been iss... It is pointed out the Newpo... Shipbuilding & Dry Dock ... issue releases fairly soon ... 10,000 tons of plates requ... an aircraft carrier just ... since considerable shop wo... be necessary before the keel ... Reports persist that the old ... yard will be rebuilt to han... of the maritime commissio... more of which is schedu... year. The navy has called ... May 24 from private ship... on four torpedo boat destro... 1630 tons each, three subma...

each and one submarine
s. In addition, navy yards
an equal number of the
s of warcraft.

ham, Ala. — Plates have
f somewhat since the be-
the second quarter. Spec-
for shipbuilding, expected
dy within 30 days, will
rially to output of that
this territory.

ncisco—Most plate inquir-
lots of less than 100 tons
three are larger. Award
700 tons of welded steel
ns of lapwelded pipe for
Calif., is still pending. To
ear 14,792 tons have been
mpared with 12,218 tons
corresponding period in

-Shops report no inquiry
jobs, although there is a
ne of spring work in lots
an 100 tons. About 300
involved in two contracts
g boat and derrick hull,
United States engineer,
d Portland.

S

Bar Prices, Page 86

nd—Bar demand is quieter,
y the result of reduced
among automotive parts-
releases of parts have been
lately, indicating lower
n in coming weeks. Mis-
s bar users are holding
uirements fairly steady,
vement generally is lack-
the tendency to refrain
ering beyond early needs

—With a decrease in auto-
emand being felt, require-
tractor manufacturers are
e main factors in the local
or carbon and alloy steel
neral buying is being done
range of interests, but in-
lots are small, indicating
eing done only for imme-
ds. The week has been
h little or no change be-
in volume of sales, follow-
orted general decline the
week.

—A well diversified demand
steel bars in small lots ac-
r most activity in bars,
n carbon material slack.
tool builders continue to
ir volume of alloys. Cold-
bars are moving slowly.
specifications are steady,
nd by railroads is light.

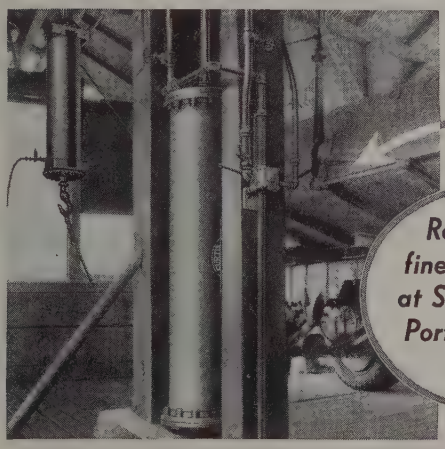
ork—Except for such steel
by government shops, air-
ilders and ship yards, bar
business is decidedly spotty. Sales recently have been the lightest in many weeks. Machine tool builders have curtailed specifications, although this appears to be only temporary. Railroad tonnage is small, and jobbers are specifying lightly.

Philadelphia — Slower specifications largely reflect easier demand for steel out of warehouse. Some seasonal improvement is noted in certain directions, but this is insufficient to offset the general declining tendency.

Buffalo—Demand for steel bars is holding at fairly good levels, although production is slightly below the peak of a year ago. Motor orders still constitute a fair percentage of business. Expansion in structural inquiries and releases, however, is one of the main market supports.

Birmingham, Ala.—Although not quite as active as in the past few weeks, bar output is holding up satisfactorily. Considerable local tonnage is being absorbed by manufacturers of agricultural implements.

CURTIS AIR HOISTS
on a tough job



Records show fine performance at Southern States Portland Cement Company

Two Curtis Air Hoists at the Rockmart, Georgia plant of the Southern States Portland Cement Company have helped to speed up operations, and reduce costs. One hoist is used to tilt loaded dump trucks into the hopper; the other to lift large boulders stuck in the crusher. Each does its job dependably and efficiently requiring a minimum of attention. (A third Curtis hoist has since been installed.)

This installation is an example of the limitless uses to which Curtis Air Hoists can be put even under unfavorable conditions. Simple in construction with only one moving part, Curtis Air Hoists are rugged and immune to injury from overloads or bad atmospheric conditions. They can be operated with ease and accuracy by unskilled labor. First cost is low, the power consumption small, and upkeep negligible.

Find out how Air Power can save you money. Send coupon below for our booklet, "How Air is Being Used in Your Industry."

CURTIS Compressors • Air & Hydraulic Cylinders
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CURTIS PNEUMATIC MACHINERY CO., 1996 Kienlen Ave., St. Louis, Mo.
Gentlemen: Please send me your booklet, "How Air is Being Used in Your Industry," and further information on Curtis Air Power Hoists.

Name _____ Street _____
Firm _____ State _____
City _____

Pipe

Pipe Prices, Page 87

Pittsburgh—Better building activity is causing a heavier movement of standard pipe from consigned stocks. Mill prices are firm, but some weakness prevails in secondary markets. March business in oil country pipe was ahead of February, but the increase was less than seasonal. In many cases only enough drilling is being done to secure leases. Little tonnage is going for pipe lines except for a few feeder lines. Demand for pressure tubing has been stimulated by slightly heavier orders from railroads, though the total remains unsatisfactory. Mechanical tubing business is holding, with March showing a substantial gain over February.

Cleveland—Standard pipe demand has yet to be influenced markedly by a seasonal betterment in building activity. Shipments lately have shown little change from the March rate. Oil country demand is re slow drilling operations, business is appearing fo work and the outlook in sion is relatively bright. national legislation to div line subsidiaries from oil is thought likely to dete tion of major lines for the ing.

Chicago — A waterw Grand Rapids, Mich., on ternate bids on cast iron, concrete are being asked pipe involved, may take 25,000 tons of cast pipe if is chosen. A materially tonnage would be involve case of steel pipe. Alab Co. is reported low on 143 Chicago, which city also market for 368 tons of 30 and 13 tons of fittings, b 10.

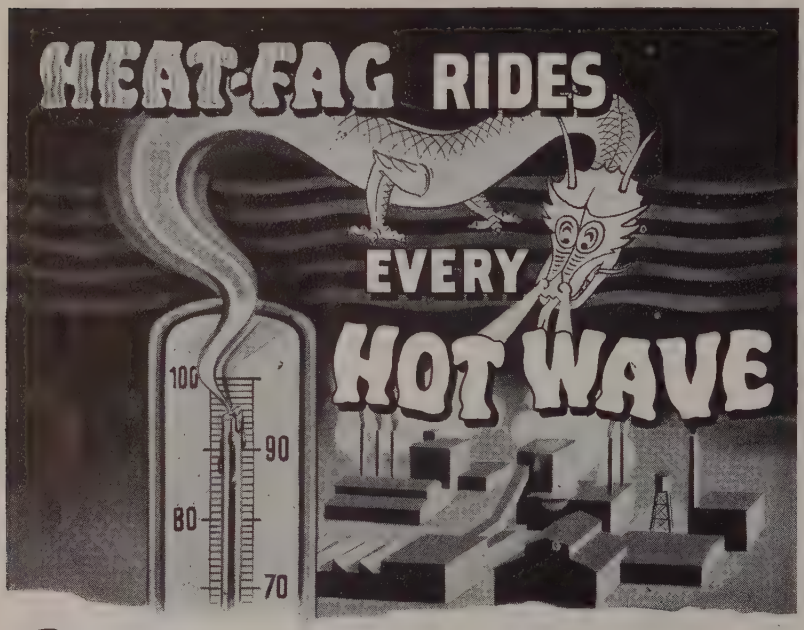
Boston—Cast pipe buying ier, close to 3500 tons hav purchased, including 1500 Bourne, Mass., placed with ett, Mass., foundry. The san ry also booked 1939 requ for Wellesley, Mass., while R. I., has bids on 1085 tons which has been placed.

New York—Pending pipe is headed by the proposal o Vacuum Oil Co. to build a line of 10-inch pipe fro River, Ill., to Lima, O., about 40,000 tons. Merchant ders show little seasonal ment, although there are sizable projects for which still is pending.

Birmingham, Ala. — Pipe by virtue of a considerable of miscellaneous business been enabled to step up pr schedules to a five-day we erally. Inquiries are sai somewhat more numerou the result that comparative factory production is expe several weeks, at least.

San Francisco—Only two pipe inquiries of size are market and pending busin not exceed 2000 tons. An a expected to be made within two weeks on 368 tons of inch pipe for Mesa, Ariz. this year 6691 tons have bee compared with 8693 tons same period a year ago.

Seattle—Demand is slow, portant projects being up for Several Pacific Northwest c districts are planning sizat but are awaiting allocation eral funds. Pacific Water Supply Co., Seattle, has been ed an unstated tonnage of and 6-inch pipe and accesso District 49, Seattle. Kent, plans an $18,400 system e



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MORTON'S SALT TABLETS

Heat-Fag is real — an unseen but powerful force that rides every hot wave . . . a force that costs industry thousands of dollars each year. For, hot days and heavy work make men sweat — and, unless the salt that's sweated out of their bodies is replaced, Heat-Fag takes its toll, production sags and profits suffer. This fact is known by medical men everywhere and by safety directors, executives and plant superintendents.

Prevent HEAT-FAG in Your Plant

Place Morton's Salt Tablet Dispensers at drinking fountains. These modern, sanitary dispensers represent the most efficient and economical way to provide workers with salt. A single push of the lever dispenses one tablet at a time.

MORTON'S SALT TABLETS
Dissolve in 50 Seconds

They are easy to take — dissolve quickly. Only the purest and most highly refined salt is used.

Anticipate the Hot Days Ahead

Install Morton's Dispensers and Salt Tablets in your plant now. Place your order today. Remember — a small investment now will pay big dividends in Heat-Fag protection. Shipment will be made promptly — prepaid.

Write for folder —"Heat-Fag"

MORTON SALT COMPANY CHICAGO, ILLINOIS

federal funds have been

e Placed

12-inch and under, Bourne, Warren Foundry & Pipe Corp., Mass.

ncluding 335 tons, 20-inch, R. I., to R. D. Wood & Co., N. J., and 250 tons, 6 to 16- and fittings, to Warren Pipe Corp., Everett, Mass.

0-inch class C, Boston, to tes Pipe & Foundry Co., Bur- J.

and 12-inch, Ipswich and Mass., to Warren Foundry & , Everett, Mass., through pro- division, Boston.

e Pending

mall sizes, Newport, R. I.;

to 12-inch; bids in at Fort sh.

pe Pending

10-inch line pipe for Socony- Oil Co. Inc., New York, for on between Wood River, Ill., , O.

ire Prices, Page 87

gh—Jobber demand for wire products continue to The buying season is late, ss shows signs of fair de- Manufacturers' wire ac- declined slightly, but not indicate a definite down- l. Producers still are hope- eavier automotive buying p this month. Automotive ave been reduced lately.

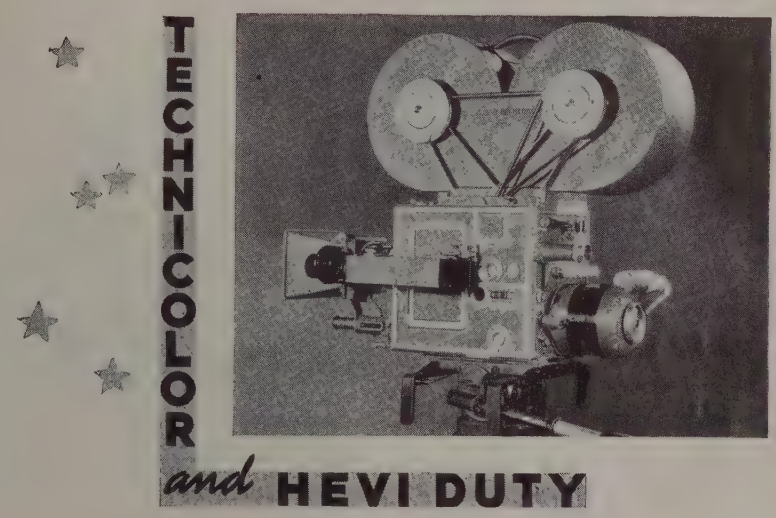
d—Changes in wire busi- light, but except for oc- uns in jobber demand for products the trend in changed or lower. Pros- heavier requirements in otive industry the next ave been dimmed some- ough fairly steady con- continues among miscel- sers of manufacturers'

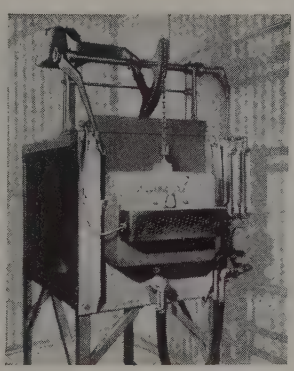
— Demand is quiet and below recent levels. ng by automotive inter- ues to lag, and there is tion whether anticipated nt in total business this ll materialize. At the , a favorable comparison h is looked for.

Incoming wire volume to improve, and aggre- ge is barely maintained. are for prompt delivery, ning operations slightly better than 50 per cent. Backlogs, having been well reduced, shipments are about in line with incoming volume. Ingot operations at all New England steelworks are now below finishing schedules, a fair stock of semifinished steel having been accumulated in each instance.

New York—Wire buying is barely maintained at the recent reduced rate, with eastern finishing operations around 50 per cent. While in spots a fair demand for a few specialties prevails, most wire products, including merchant goods, are lagging and more consuming industries are less active. Improvement having failed to materialize last month, sellers are more uncertain as to April business which to date has not turned upward. Rod business is light and the bulk of finished goods orders are for small tonnages for prompt delivery.

Birmingham, Ala.—Wire products have shown the most consistent demand of any major steel product. Production is at about 75 per cent.





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MILWAUKEE, WISCONSIN

Behind the Scenes with STEEL

Opry Fan

■ Last week was opera week here in Cleveland. The little woman had notified us well in advance that we were slated for Friday night's performance of *Lohengrin,* and we couldn't get out of it in spite of feigning a broken leg and a splitting headache. And so, for what seemed like hours we squirmed and grew restless while *Elsa* and *Lohengrin* build up to the high spot of the whole affair—the wedding march. The curtain is slowly drawn on an empty stage, and the orchestra takes up the first strains of music and the audience of over 9000 is all pins and needles waiting for the big entree. And then, right at this crucial moment, the dizziest looking bozo comes trotting right smack across the stage, coat tails flying, and hell bent for the other side, for what reason no one will probably ever know.

Jolly Ol' Train

■ We sneaked an extra half-hour for lunch the other day and took a peek at *The Coronation Scot* which the London, Midland and Scottish Railway had on exhibition at the terminal here on a tour prior to parking at the New York World's Fair this summer. She is rilly quite a train, holding the British speed record of 114 m. p. h. and regularly making her daily run of 400 miles at an average of over 60. Like all English trains, she (the attendants call her she) is a bit smaller than the American streamliners. The permissible limits of height and width are smaller in England because the British railways had to buy their own right of ways and naturally they bought just as little as they could get away with, while the U. S. roads had their right of ways tossed in their laps. The coaches are all very nicely decorated with many kinds of choice woods used. There were dozens of *empty* bottles of Scotch on display at the cocktail bar, carefully guarded, nevertheless, by a uniformed London Bobbie. Two Bobbies guarded each of the 8 cars against souvenir hunters, and two Cleveland cops guarded the Bobbies. A school kid in front of us lifted up the hand-embroidered quilt in one of the sleeping compartments and looked furtively under the bed. There was only a small wash stand in the room. Everything worked out all right, however, and the kid and ourselves stopped off at Harvey's afterwards for a chocolate soda.

Week Late

■ This cartoon from the *Chicago Tribune* should have illustrated the lead story in STEEL last week.

NOT EXACTLY AN INCENTIVE
GO AHEAD, AND IF YOU PROFIT, I TAKE IT— IF YOU LOSE, YOU TAKE IT!
THE GOVERNMENT
INVESTMENT
MORE AND MORE POWER TO YOU

Lady Nicotine

■ For some unexplainable reason, we decided last week to stop smoking. Never again will the filthy weed touch our lips. Well, not for three weeks, anyway because in order to bolster our courage we had to back it up with a cash money bet with some of the skeptics around the office. As we move into the third day (with a big stag luncheon scheduled for this noon) our pulse is barely noticeable, our digestion poor, and our respiration jerky. Woe is us.

Nice Thought

■ One of our friends, with beautiful sense of expression, last week said: When Ann laughs the angels in heaven must smile.

SHRDLU

Rails, Ca

Track Material Prices, P

Railroad buying is ligh and cars but about 4000 pending, with expectation portion will be placed th Further rail buying is a to be done, as important r not yet placed their 193 ments. The Santa Fe is to buy about 50,000 tons to its tracklaying program, in to a large carryover from

Freight cars placed in taled 800 units. This comp 2259 cars in February and c in January, and brought for the first quarter up to 3 latter figure compared wi the corresponding period 30,933 in the same period and 9582 in the first thre 1936.

The St. Louis South We ordered 100 underframes ton Hart convertible ballast 100 for 40-ton flat cars fro ican Car & Foundry Co., N

Merchants Dispatch awarded about 2400 tons shapes, bars, wheels, axles cial castings for 200 seven ment cars to be built in its o at Rochester, N. Y., beginn 1.

	1939	1938	193
Jan.	3	25	17,8
Feb.	2,259	109	4,9
March	800	680	8,1
3 mos.	3,062	814	30,9
April		15	9,7
May		6,014	4,7
June		1,178	5
July		0	1,0
Aug.		182	1,4
Sept.		1,750	1,2
Oct.		2,537	1,3
Nov.		1,232	2
Dec.		2,581	2
Total		16,303	51,6

Car Orders Placed

Merchants Dispatch Inc., 200 s cement cars, to own shops, N. Y.

St. Louis Southwestern, 100 st frames for 50-ton convert cars and 100 for 40-ton fla American Car & Foundry York.

Weyerhaeuser Timber Co., Wash., 200 railroad logging Pacific Car & Foundry Co., S

Rail Orders Placed

Bangor & Aroostook, 2551 tons, lehem Steel Co., Bethlehem, P

Boston Elevated, 1325 tons, to Steel Co., Bethlehem, Pa.

Buses Booked

American Car & Foundry M New York: Thirty-one for Transportation Co., Upper D four for Georgia Power Co.

e for Jamaica Buses Inc., N. Y.; two for Quaker City Inc., Ocean City, N. J.; two ay Trails Inc., New York; Southern Kansas Greyhound , Kansas City, Mo.; two for ansit Co., Saugus, Mass.

Co., Philadelphia: Fifty-two otor 40-passenger trolley or Delaware Electric Power ington, Del.

pes

al Shape Prices, Page 86

rk — Estimated steel re- s for the twin suspension ttery Park, Manhattan, to avenue, Brooklyn, ap- 100,000 tons, about three o be structural material ain crossing, approaches s. Approval of the war t for the structure still ructural contracts include 3,000 tons, miscellaneous equiring little shop work dition sections, Delaware Ulster county, New York. ry is slightly heavier, in- 500 tons for Brentwood, te hospital buildings on rner Construction Co., is low.

gh—Awards remain dis- , although there have fairly large inquiries an- ecently. The new awards st entirely on public

d—Mt. Vernon Bridge Co., n, O., is low on 1800 tons arter road bridge super- here. Awards include 1800 piling for the Cuyahoga ightening project here to llinois Steel Corp. and 670 ,000 feet of pipe piling for 21st bridge, Lorain, O., to Tube Co., Lorain. In- e expected soon on 3500 two vertical lift bridges Cuyahoga river; also 3000 the Marshall and Erie ges, Youngstown, O., and tons will be required for

Awards Compared

	Tons
ed April 8	15,805
d April 1	32,489
d March 25	15,840
, 1938	29,484
erage, year 1938..	21,566
verage, 1939	24,696
erage, March	21,240
tte, 1938	223,178
tte, 1939	321,047

wards of 100 tons or more.

the Erie avenue and East 21st bridges at Lorain, O.

Chicago—Continued evidences of the spring improvement has been noted here. Tonnage pending disposition is increasing weekly, while closings on projects that have been hanging fire throughout the winter are expected soon.

In reference to the general state of finished steel ordering, some quarters are hopeful the structural and plate demand will increase sufficiently to offset losses that may be noted in other lines during the second quarter, such as in rail orders.

Boston — Bridge contracts total 500 tons, mostly small spans, including two for Connecticut, 295 tons, the remainder I-beam spans, Vermont. Building construction needs are light, public projects absent with the exception of several schools. Awards include 240 tons for a bottling plant, Worcester. Fabricated and erected structural steel prices are soft with most of the moving tonnage going to shops outside the New England district.

Philadelphia—McCloskey & Co., Philadelphia, is low on an office building, Harrisburg, requiring 1125 tons of structurals and 160 tons of bars. Low cost housing project here will take 1000 tons of structurals and 300 tons of bars, bids April 16.

Buffalo—While major activity is centered on school projects several sizable jobs are expected to be up for bids soon. First of these is the new $1,200,000 Kleinhans Music hall on which foundation work is now underway. The $2,700,000 new convention hall is also expected to be underway here in the near future. Another large project pending is a bridge to replace the collapsed Honeymoon span, Niagara Falls.

Birmingham, Ala. — Structural shapes have found a somewhat widened market, following inactivity the past two weeks. Indications are that highway work will create a rather steady demand for some weeks. Production is estimated at better than 65 per cent.

San Francisco—The only award of size involved 300 tons for 12 oil derricks, Long Beach, Calif., taken by an unnamed interest. Awards totaled 1474 tons and brought the aggregate to date to 36,870 tons, compared with 29,510 tons last

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year. Pending business does not involve over 4000 tons.

Seattle—Largest contract awarded by private industry in several weeks went to Pacific Car & Foundry Co., Seattle, which will build 200 connected truck-body railroad logging cars for the Weyerhaeuser Timber Co., involving about 600 tons of shapes and plates. Bethlehem Steel Co., San Francisco, is low at $50,823 on 375 tons for seven power substations for the Bonneville authority. Tacoma will receive bids April 10 for a steel municipal light substation.

Shape Contracts Placed

6500 tons, including tunnel ribs, structural tunnels supports, reinforcing material and inner lining, contract 316, Delaware aqueduct, Gardiner, Plattekill and Marlboro, Ulster county, New York, to Carnegie-Illinois Steel Corp., Pittsburgh; Walsh Construction Co., New York, general contractor.

1800 tons, piling, Cuyahoga river straightening project, Cleveland, to Carnegie-Illinois Steel Corp., Pittsburgh; through Great Lakes Dredge & Dock Co., Cleveland.

1000 tons, Delaware aqueduct, contract 313, Wawarsing, N. Y., for New York City, to Archer Iron Works, Chicago.

750 tons, bridge over Kentucky river, Irvine, Estill county, Kentucky, to Pittsburgh-Des Moines Steel Co., Pittsburgh.

670 tons, 25,000 feet of pipe piling, East Twenty-first street bridge, Lorain, O., to National Tube Co., Pittsburgh; Great Lakes Dredge & Dock Co., Cleveland, general contractor.

625 tons, piling, Erie avenue bridge, Lorain, O., to Carnegie-Illinois Steel Corp., Pittsburgh; through Great Lakes Dredge & Dock Co., Cleveland.

600 tons, including plates, 200 logging cars for Weyerhaeuser Timber Co., Tacoma, to Pacific Car & Foundry Co., Seattle.

550 tons, court house, Elizabeth, N. J., to H. R. Goeller, Hillside, N. J.

450 tons, fourth section, Chicago subway, to American Bridge Co., Chicago, by John Marsch, general contractor.

400 tons, apartment, East 156th street, New York, to Harris Structural Steel Co., Plainfield, N. J.

300 tons, Erie avenue bridge, Lorain, O., to Mt. Vernon Bridge Co., Mt. Vernon, O.; through Great Lakes Dredge & Dock Co., Cleveland.

300 tons, 12 oil derricks, Long Beach Oil Development Co., Long Beach, Calif., to unnamed interest.

250 tons, building, Sikorsky Aviation Corp., Stratford, Conn., to Truscon Steel Co., Youngstown, O.; through Edward Moss & Sons, Bridgeport, Conn.

225 tons, Washington high school stadium, Massillon, O., to Fort Pitt Bridge Works, Pittsburgh, erroneously reported in April 3 issue as placed with American Bridge Co., Pittsburgh.

225 tons, grade separation bridge, Inkster, Mich., for Wayne county, to Fort Pitt Bridge Works, Pittsbur

205 tons, Cross island park separation, New York, to Bridge Co., Pittsburgh.

200 tons, community and building, Sault Ste. Marie, Bethlehem Steel Co., Bethleh

195 tons, state bridge, Exchar Athol, Mass., to American Pittsburgh.

190 tons, Memorial hospital, R to American Bridge Co., through White Construction

175 tons, girder spans, Rathb for Chicago, Milwaukee, S Pacific railroad, to Bethle Co., Bethlehem, Pa.

175 tons, bridge, Athol, Mass., can Bridge Co., Pittsburgh.

140 tons, transportation bu Washington, for District of to Belmont Iron Works, Ph

105 tons, garage, Gordon B Long Island City, N. Y., t Iron Works, Philadelphia.

Shape Contracts Per

100,000 tons, three-fourths s twin suspension bridge and a Battery Park, New York-Har nue Brooklyn, to be e Triborough bridge author York; financing now in prog approval of war department

4500 tons, state hospital buildin wood, N. Y.; Turner Constru New York, low.

3700 tons, superstructure, Eas first street bridge, Lorain, April 18.

3500 tons, two vertical lift Cuyahoga river, Cleveland;

3000 tons, Erie avenue brid structure, Lorain, O.; bids s

3000 tons, Marshall and E bridges, Youngstown, O.; bids

1870 tons, Carter road bridge, Mt. Vernon Bridge Co., Mt. V low.

1800 tons, bridges, Sacramen Redding, Calif.; bids to bureau mation, April 21.

1225 tons, office building, lic trol board, Harrisburg, Pa.; M & Co., Philadelphia, low; also of bars.

1100 tons, contract 6, East Riv New York; J. Rich Steers York, low.

1000 tons, plant building, Celan Narrows, Va.; Hughes-Foul Philadelphia, general contrac

1000 tons, housing project, Phil bids April 26.

700 tons, grade separation, S land, N. Y., for Staten Isla Transit Co.

675 tons, Sideling hill tunnel, vania turnpike commission Corp., low.

600 tons, grade elimination, Va.; bids April 11.

600 tons, grade crossing, Gre Staten Island, N. Y.; bids Ap

600 tons, addition, Bowen buildi ington; bids in.

500 tons, social security buildin ington; bids April 26.

450 tons, power house, Kansas Light Co., Abilene, Kans.

375 tons, Laurel Hill tunnel, vania turnpike commission; Conkey Construction Co., low.

375 tons, seven power substa Bonneville authority; Bethleh

ehem, Pa., low.
factory building, for Allis- Mfg. Co., Pittsburgh.
reverse flow coaster gates, ulee dam, Wash., specifica- American Bridge Co., Pitts- w.
Clyde central school, Galen, board of education.
Woolworth building, New Or-

Wrightwood avenue viaduct, Northern Bridge Co., low

partment, Wynnewood, Pa.; dley Co., Philadelphia, gen- ractor.
t. Elizabeth hospital, Wash- r United States government.
Louis & San Francisco rail- ge, Moselle, Ill.; bids in.
39 plant extension, for Lever gewater, N. J.
uditorium, Lake Charles, La.
ills bridge, Tillamook county, ids opened.
buildings, for Draper Corp., Mass.
highway bridge, McNamara,

Bedford dwellings, for Pitts- using authority, Pittsburgh.
eater building, Oswego, N. Y., ge & Second Street Realty

ddition to building, for Elk- her Co., Elkland, Pa.
derpass, specification 1209-D, alif., for bureau of reclama-

ate bridge, Searsboro, Iowa.
ridges, for Alaska railroad on; bids opened at Seattle.
3 high transmission towers eville authority; Fritz Zie- ng Beach, Calif., low.
five span, 445-foot state Big Blackfoot river, Mont.; Bridge Co., Portland, Oreg., ontractor.
Pacific avenue power substa- oma, Wash.; bids April 10.

nforcing

ing Bar Prices, Page 87

rk—Reinforcing steel con- slightly more numerous, ting 2500 tons. Pending st of which already bid, ted at around 6000 tons, 3000 tons for a section of River drive, New York. age for New Jersey state nd bridge projects pends, highway needs for New e are lagging. Prices are y steadier, but the bulk e still moves under listed .

gh—Reinforcing awards g at the level of recent th fair tonnages pending r projects awaiting clear- engineers and estimators aching the bidding stage. largely public projects on tial work was done late In most instances it has been a jam in technical divisions which held up the work.

Cleveland—Inquiries from private sources continue disappointing, but a fair volume of work from public channels is still appearing. E. Elford Co., Columbus, O., has been awarded 270 tons for a state university mens' dormitory, Columbus. Awards are expected soon for an auditorium, Oberlin, O., involving 250 tons and for a mill run storm sewer, Steubenville, O., requiring 300 tons. Prices continue weak with keen competition noted even on the small tonnage work.

Chicago — Demand continues brisk, with difficulty still encountered in estimating pending projects. Large volume of minor tonnages is growing, involving considerable private work. Chicago subway continues the most prominent factor. Merritt, Chapman & Scott, New York, is low on the general contract for section S-4A, and Herlihy Mid-Continent Co., Chicago, for section S-4B, bids April 6.

Philadelphia—Interest in the reinforcing market has been enlivened by an announcement of the bidding date, April 26, for the Security board office building, Washington, taking 900 tons of reinforcing and 500 tons of shapes. Flood control work is more promising with projects planned in New York, Pennsylvania and Richmond, Va., latter involving a $2,000,000 dam. Fair volume of small jobs continue to appear for bids.

San Francisco—Demand has receded further and the market remains inactive at the moment. Awards aggregated 1090 tons, bringing the total to date to 56,814 tons, compared with 25,868 tons in 1938. Unnamed interest secured 300 tons for a postoffice at Riverside, Calif. The largest pending project involves from 2000 to 3000 tons for a parcel post building at San Francisco, bids April 18.

Seattle — Public work projects continue to furnish the bulk of awards, industrial demands being subnormal. Plants are operating as

Concrete Bars Compared

	Tons
Week ended April 8	3,852
Week ended April 1	11,872
Week ended March 25	9,113
This week, 1938	2,872
Weekly average, year, 1938	6,959
Weekly average, 1939	11,291
Weekly average, March	10,279
Total to date, 1938	68,951
Total to date, 1939	146,789

Includes awards of 100 tons or more.

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Cleveland

orders accumulate. Bethlehem Steel Co. was awarded 263 tons for the Coulee dam and is low on 2220 tons for the same project. This job is expected to be rolled at the Seattle mill. Denver opened bids March 30 for furnishing 28,102 pieces bars, tonnage unstated, for the Roza diversion dam, Washington state.

Reinforcing Steel Awards

475 tons, paving, two contracts, Circumferential highway, New York, to Seaboard Steel Products Co., National Excavation Co., New York, general contractor.

435 tons, sewer and paving, Southern Parkway, Queens, N. Y., to Igoe Bros. Co., New York; through P. Tomasetti Contracting Co., New York.

415 tons, sewage disposal plant, New Haven, Conn., to Concrete Steel Co., New York.

350 tons, men's dormitories, University of Michigan, Ann Arbor, Mich., to Jones & Laughlin Steel Corp., Pittsburgh; through Taylor & Gaskin, Detroit.

300 tons, postoffice, Riverside, Calif., to unnamed interest.

275 tons, East Twenty-first street bridge, Lorain, O., to Carnegie-Illinois Steel Corp., Pittsburgh; through Great Lakes Dredge & Dock Co., Cleveland.

270 tons, State University dormitory, Columbus, O., to E. Elford Co., Columbus, O.

263 tons, Coulee dam project, to Bethlehem Steel Co., Seattle.

175 tons, relief sewer, West New York, N. J., to Bethlehem Steel Co., Bethlehem, Pa., through Faitoute Iron & Steel Co., Newark, N. J.

154 tons, invitation 4/7956, procurement division, U. S. treasury, Columbus, O., to Republic Steel Corp., Cleveland; through Patterson-Leitch, Cleveland.

150 tons, postoffice, Venice, Calif., to unnamed interest.

150 tons, high school auditorium, El Monte, Calif., to Consolidated Steel Corp., Los Angeles.

150 tons, Erie avenue bridge, Lorain, O., to Carnegie-Illinois Steel Corp., Pittsburgh; through Great Lakes Dredge & Dock Co., Cleveland.

140 tons, power plant, San Diego Consolidated Gas & Electric Co., San Diego, Calif., to unnamed interest.

125 tons, East Park school, Poughkeepsie, N. Y., to Ceco Steel Products Co., Jersey City, N. J.

130 tons, health service building, Ann Arbor, Mich., to Truscon Steel Co., Youngstown, O.

125 tons, Pilgrim state hospital, Brentwood, N. Y., to Bethlehem Steel Co., Bethlehem, Pa.

110 tons, building, Anchor Hocking Glass Co., Salem, N. J., to Bethlehem Steel Co., Bethlehem, Pa.

100 tons, addition to Kern general hospital, Bakersfield, Calif., to unnamed interest.

100 tons, apartment, Wynnewood, Pa., to American Steel Engineering Co., Philadelphia; through Nelson-Pedley Co., Philadelphia.

Reinforcing Steel Pending

9000 tons, social security building, Washington; bids April 26.

3000 tons, contract 6, East River drive, New York; J. Rich Stee... York, low; bids April 3.

2210 tons, Coulee dam pr... hem Steel Co., low.

2000 to 3000 tons, parcel ... San Francisco; bids Apri...

850 tons, flood control, Cone... army engineers, Johnstow...

500 tons, viaduct, Providenc...

400 tons, Rock creek sewer, ...

300 tons, housing project, ... bids April 26.

280 tons, invitation 4/7910, ... division, U. S. treasury, C... Builders Structural Steel ... land, low bidder.

250 tons, six infirmary buildi... brook, N. Y.

200 tons, contract No. 3, ... water supply system, Har... Edward H. Ellis, Weste... general contractor; also ... plates.

200 tons, garage, Monroe str...

200 tons, housing project, b... G, Syracuse, N. Y.

158 tons, auditorium for M... high school, San Francis... Bros., 475 Sixth street, Sa... awarded general contract.

150 tons, treasury departmen... 52,906; bids opened.

150 tons, dormitory, South ...

144 tons, addition to hospita... Calif.; bids opened.

140 tons, assembly hall for ... Sacramento, Calif.; general ... Campbell Construction Co., ... Calif.

140 tons, soy bean elevator, ... Iowa.

139 tons, invitation OS-12800 ... chasing bureau, Maryland.

135 tons, elementary school, ... Iowa.

122 tons, invitation WP-9-C-3... ment division, U. S. treas... ment, bids April 7, state ... office, Baltimore.

120 tons, addition, Tobey hos... ham, Mass.

100 tons, sewage disposal pl... O., Bever & Morris, Clevela...

Unstated, 28,102 pieces reinfo... for Roza project; bids in a...

Pig Iron

Pig Iron Prices, Page ...

Cleveland — Shipments ... steady, but consumption ... ed adversely by reduced ... ments of automotive inte... erations of jobbing foun... maintained despite absenc... ficient backlogs to permit ... ing casting production fa... Improvement in building ... has yet to be reflected in ... pig iron demand from pipe... Pig iron buying generally is ... lots for prompt delivery.

Chicago—Shipments dur... week of April show no cha... same period last month, sa... true of by-product found... movements. Thursday of ... was indicated by one intere... ing the heaviest day for r...

ng orders in many weeks
nates for the month as a
ever, do not point to any
at over March, total
expected to be on a par.
Slackening demand for
as been complicated by
es in Rhode Island and
are down. The situation
apped consumers buying
lots, although melt has
ow improvement, having
some instances. Buying
ots with prices generally

rk—Pig iron shipments
ead of incoming business.
ntinues light, with many
nable to move their op-
ove three days a week.
dvance of spring, heavier
of pipe and building hard-
oked for. Machinery re-
are perhaps the most ac-
tly.

hia—Coke shipments in-
dry operations may be
lightly, although March
st month since June, 1937.
ess is quiet with prices
cept for a reported few
erings of distress iron.

ti—Shipments are steady
arter levels, but consump-
bing foundries is declin-
continue light, following
ive contracting for the
Orders for machine tool
are unabated. Foundry
fications are spotty, with
hanged.

Ont. — The melt is sus-
about 60 per cent, but
melters covered for early
business is slow. Spot
age about 1000 tons week-
orders are reported down
nt from a year ago, im-
mand is looked for later
n.

ap

rap Prices, Page 90

gh—With most of the out-
onnage on short sales cov-
mills not inclined to place
business, the market here
Available scrap is light,
nd is even quieter, par-
ince mills still owed scrap
ld orders are retarding
. At the same time, dis-
nage is small and quota-
rally are unchanged. No.
melting steel continues
$16.

d—Iron and steel scrap
re, while for the most
anged, due to lack of ac-
age sales, show evidences
ess. This softness, while sentimentally evident currently, is expected to take quotational form following railroad list closings. New business is at a minimum as the trade continues to pursue a waiting attitude.

Chicago—The market tone is easier, and a number of grades are quoted lower. No. 1 heavy melting steel is nominal but unchanged at $14 to $14.50 on the basis of last mill purchases. Cast borings are down 50 cents, while springs, tires, short rails and angle bars also have been marked down.

Boston—Scrap prices are generally unchanged, both for domestic shipment and dock delivery for export with most activity confined to the latter. Demand by New England and Eastern Pennsylvania consumers is unusually light. Foundries in this district are buying in small lots from nearby sellers, while steel works, curtailing open hearth operations, are taking in little scrap.

New York—Buying is light, with domestic prices for eastern Pennsylvania and nearby delivery unchanged. Mills are taking small shipments, generally against old orders, and movement of foundry grades also continues limited. Most activity is for export at unchanged prices. What buying was done by the cartel representatives here was more in the nature of an extension of old contracts and probably was under 75,000 tons.

Philadelphia—The market tone is slightly easier, but so far this is not reflected in lower prices. In fact, a sale of 3400 tons of compressed sheets at $14.54, f.o.b. plant, or $16.07 delivered, is indicative of the price situation. Brokers also are offering $15.50, Port Richmond, for No. 1 steel and $13.50 upward for No. 2 for export. Heavy breakable cast is weak and available at $15.

According to latest reports, the European cartel placed about 50,000 tons of scrap with various brokers at $13.50 for No. 2 and $15 for No. 1. In effect, the purchase amounted to an extension of the previous order placed at the same figures.

Other reports indicate the so-called extension of old export orders may have involved 150,000 tons. Many fail to understand why additional tonnage was sold at prices under levels at which old orders now are being covered. According to one explanation this loss is made up by sales of old compressed sheets and railroad scrap at more favorable prices.

Buffalo—The market is irregular but with no substantial sales to clarify prices. No. 1 heavy melting steel nominally continues $13.75

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640 Central Ave., Pontiac, Mich.

to $14.25. Dealers refuse to accept lower bids on any large lots, while mills are equally adamant regarding prices. Shipments are limited, with one mill holding up all receipts.

Detroit—Scrap prices are easier here, reflecting uncertainty caused by spotty steel business, lagging car sales and the European situation. No. 2 heavy melting steel, flashings, bundles, stove plate and turnings have been marked down 25 to 50 cents. Bundled sheets are down to $11.50 to $12.

Cincinnati—Prices are down 50 cents on most grades, the weaker market being inspired partly by reduced steelmaking. Considerable covering of contracts has been done the past 30 days against immediate mill needs, and the market currently is without urgent consumer demand.

St. Louis—Scrap is in the quietest market experienced in a number of months, with prospects unfavorable for an early revival. Sales and inquiries are scant, and quotations have weakened on a number of grades, principally rails, sheets and specialties. Mills are taking shipments against old contracts, and with offerings smaller little distress scrap is accumulating.

Toronto, Ont.—Scrap trading continues dull despite some movement in such grades as heavy melting steel and machinery cast. Some dealers are piling scrap on docks for spring shipment, considerable tonnage having been accumulated recently. Receipts by local yards are gaining steadily and are well in excess of shipments.

Warehouse

Warehouse Prices, Page 89

Cleveland — Sales are fairly steady, the first week of April showing little change from the volume of late March. While recent business developments have affected the outlook unfavorably, some distributors look for a moderate upturn in demand later this month.

Chicago — Business has improved moderately so far this month, in line with expectations. Demand is coming from a broad list of consumers. Inquiries also are more active.

Philadelphia—Business is off to a slow start this month, with sales the first week considerably under March. However, last month was the best of the past 15. Some items, such as fencing and galvanized sheets, are seasonally more active.

Buffalo — Recent gains in sales have been largely seasonal. Structural products are moving less freely than usual for this period.

Cincinnati — Sales so far this month are maintaining the better pace attained in March. Steel needs for building purposes are slow to increase.

St. Louis — Warehouses have reduced prices on plates, shapes, sheets and bars from 15 to 35 cents per 100 pounds, the major cut applying to shapes and floor plates. This is reported to be purely a local situation and the result of severe competition from fabricators and other sources. Business is the best in a number of months.

Tin Plate

Tin Plate Prices, Page

Tin plate specifications improved slightly, and although volume is below normal for the operations have moved up to 62 per cent. Movement for sanitary can production is relatively light, but demand is expected shortly.

Excess stocks of canned restrict tin plate activity. trade leaders now are a light food pack this summer. cifications for beer containers fairly good, and improvement more apparent in some gauges. Export inquiry continues

Steel in Europe

Foreign Steel Prices, Page

London—(*By Cable*)—al blast furnace has been to meet heavy demand for ing iron in Great Britain. pig iron; however, is dull. S on the Northeast Coast are larly active and production creasing. The air ministry placed a £1,000,000 aerodrome contract. Works in the Mid active. The automobile trade veloping. Trade in tin has increased 100 per cent in three months.

The Continent reports trade holding against adverse tions. Markets in South and the Far East show int

Bolts, Nuts, Rivets

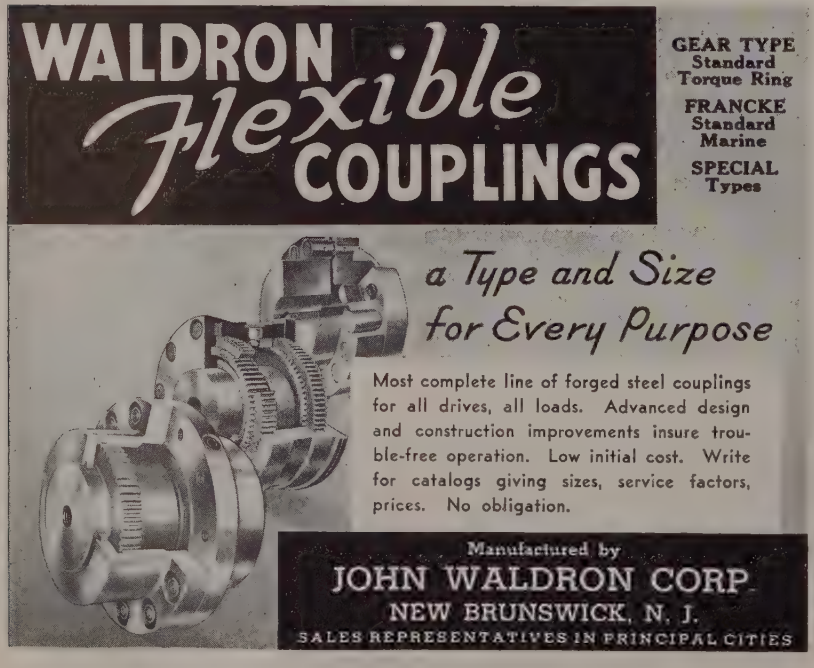
Bolt, Nut, Rivet Prices, Page

What slight improvement peared in bolt, nut and mand the past 30 days below expectations. Au needs still lag, but requirements farm equipment builders maintained and some miscellaneous users are slightly more active specifications continue the sustaining factor in the East new orders have appeared but releases against old orders are coming out freely. Prices erally are holding.

Refractories

Refractories Prices, Page

Pittsburgh — Silica brick for second quarter delivery been raised $7.50 per thousand $47.50 f.o.b. Pennsylvania and mingham, Ala., plants.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SALES REPRESENTATIVES IN PRINCIPAL CITIES

price to the level of last
when an equal decrease
was made. Silica brick,
t and East Chicago, Ill.,
increased from $49 to
he price at these points
ed from $56.05 to $49 in
1938. Other refractory
e been reaffirmed for sec-
er.

Ore

Ore Prices, Page 90

nd — Little discussion is
yet regarding iron ore
the coming season. In-
ill are awaited, with the
ipments apparently about
s removed. April 20 is
t estimate of the probable
the initial movement, al-
is figure is subject to vag-
he weather. Ice continues
uluth harbor.

— Steamer JOSEPH BLOCK
and Steel Co.'s ore freight-
Manitowoc, Wis., April 1
Inland, Mich., its first trip
eason. It will load lime-
m Inland Lime & Stone
ry and crushing plant and
the steelworks at Indiana
nd., being scheduled to ar-
l 11. This is one of the
rips on record.

ous Metals

ork. — Tenseness in the
political situation contin-
e the dominating influence
rrous metal markets last
slight recovery was re-
London prices on Thurs-
to the holiday which will
rough Easter Monday. No
al improvement in the mar-
expected until foreign un-
s clear.

—The electrolytic market
confused due to the ex-
f three prices. American
& Refining Co. reduced
cent late Monday to 10.75c,
ut. All leading mine pro-
ontinued to quote 11.25c,
for drawn and rolled prod-
s. Interests in the outside
ontinued to quote variable
resale metal with the close
t 10.30c. Price reduction by
ling custom smelter was
an effort to bring the do-
arket in line with the world
and to stimulate buying.
r's supplies are at an all-
and any wide move to re-
these stocks would absorb
it is believed, offerings be-
mine producers' price. The
market held up fairly well
ces ranging from 10.20c to 10.35c, c.i.f. European ports. Foreign sales improved whenever the market appeared stronger although Germany is finding it increasingly difficult to obtain tonnages here. Bookings here were well above the recent daily average. Red metal scrap and brass ingot prices moved lower.

Zinc—A slight recovery in London prices on Thursday relieved somewhat the pressure created by the threat of imports. Despite light new business the domestic market is

Nonferrous Metal Prices

Spot unless otherwise specified. Cents per pound.

April	Electro, del. Conn.	Copper Lake, del. Midwest	Casting, refinery	Straits Tin, New York Spot	Straits Tin, New York Futures	Lead N. Y.	Lead East St. L.	Zinc St. L.	Aluminum 99%	Antimony Amer. Spot, N.Y.	Nickel Cathodes
1	11.25	11.37½	10.17½	46.25	46.15	4.85	4.70	4.50	20.00	11.50	35.00
3	10.75	11.37½	10.22½	46.55	46.45	4.85	4.70	4.50	20.00	11.50	35.00
4	10.75	11.37½	10.00	46.20	46.15	4.85	4.70	4.50	20.00	11.50	35.00
5	10.75	11.37½	10.00	46.20	46.10	4.85	4.70	4.50	20.00	11.50	35.00
6	10.75	11.37½	10.00	46.15	46.15	4.85	4.70	4.50	20.00	11.50	35.00

7—Holiday.

MILL PRODUCTS

F.o.b. mill base, cents per lb. except as specified. Copper brass products based on 11.25c Conn. copper

Sheets

Yellow brass (high) 17.31
Copper, hot rolled 19.37½
Lead, cut to jobbers 8.00
Zinc, 100 lb. base 9.75

Tubes

High yellow brass 20.06
Seamless copper 19.87½

Rods

High yellow brass 12.62
Copper, hot rolled 15.87½

Anodes

Copper, untrimmed 16.62½

Wire

Yellow brass (high) 17.56

OLD METALS

Nom. Del. Buying Prices

No. 1 Composition Red Brass

New York 6.00-6.25
Cleveland 6.75-7.00
Chicago 6.25-6.50
St. Louis 5.87½-6.12½

Heavy Copper and Wire

New York, No. 1 ..... 8.00-8.12½
Cleveland, No. 1 ..... 7.87½-8.12½
Chicago, No. 1 ..... 7.62½-7.87½
St. Louis 7.87½-8.12½

Composition Brass Borings

New York 5.25-5.50

Light Copper

New York 6.50-6.75
Cleveland 6.12½-6.37½
Chicago 6.25-6.50
St. Louis 6.12½-6.37½

Light Brass

Cleveland 3.75-4.00
Chicago 4.00-4.25
St. Louis 3.37½-3.62½

Lead

New York 4.10-4.35
Cleveland 3.50-3.75
Chicago 3.60-3.85
St. Louis 3.25-3.50

Zinc

New York 2.50-2.62½
Cleveland 2.00-2.25
St. Louis 2.00-2.25

Aluminum

Borings, Cleveland 6.25-6.50
Mixed, cast, Cleveland 7.75-8.00
Clips, soft, Cleveland 14.75-15.00
Mixed cast, St. Louis 7.75-8.25

SECONDARY METALS

Brass ingot, 85-5-5-5, less carloads .. 10.50
Standard No. 12 aluminum 12.50-13.00

Hollow Bored Forgings and Steel Shafting

LATHE SPINDLES
HYDRAULIC CYLINDERS
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RAMS

American Hollow Boring Co.
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fairly sound with shipments holding up at satisfactory pace and with stocks declining for the second successive month. Prime western held at 4.50c, East St. Louis.

Tin—Straits spot slipped to 46.15c at the close from the week's high of 46.55c. Moderate tonnages were booked on a few days but generally the market was quiet.

Lead—Due to the well covered positions of consumers, buying was light and confined to fill-in tonnages for immediate delivery. Prices held at 4.70c, East St. Louis.

Equipment

New York — Domestic machine tool orders are gaining, notably from shops connected with the aircraft industry. Buying by shipyards is also encouraging, heavy equipment business being active. The Fore River, Quincy, Mass., plant, Bethlehem Steel Co., has placed attractive orders, with other yards retooling for the construction of new and larger ships. The Springfield, Mass., armory, having placed scores of machines for the construction of a new automatic rifle, continues to inquire for machines, notably millers. In addition, miscellaneous buying is sustained, buyers closing on considerable equipment pending for some time.

Chicago—First week of April has started off at a good pace, with possibility that business for the month as a whole may come close to March volume, which for some interests was reported best since July, 1937. Road machinery interests are prominent buyers at this time, being in good season and with rush orders noticeable. Agricultural requirements are consistent, but at present railroad buying is rather light. Inquiries continue in good volume but some spottiness in tone is detected.

Cleveland—Resistance to closing on business already figured is noted here by some dealers, although a large amount of business remains active. Builders' activity generally is fair, although dealers express uncertainty about the immediate future. Whether the increase in domestic orders of the past few months continues through the spring depends largely on foreign developments, they believe. Monarch Machine Tool Co., Sidney, O., recently was awarded contract for more than $65,000 for lathes by the government. Cleveland Graphite Bronze Co. last week submitted to stockholders a proposal for a $2,000,000 building and expansion program.

Construction and Enterp

Ohio

ASHLAND, O.—City, W. A. Mason, mayor, will start survey in projected construction of water softening plant to cost $25,000, and additional capacity of water reservoir. Consulting engineer, E. D. Barstow, Akron, O. (Noted March 20.)

ASHLAND, O.—City, W. A. Mason, mayor, takes bids due at noon, April 22, on construction of a sewage disposal plant costing about $157,000, and including primary settling tanks, motor-driven rotary distributors, secondary tanks, chemical treating equipment, incinerator, and miscellaneous equipment. Certified check or bid bond 5 per cent to accompany bid. E. D. Barstow, Akron, O., consulting engineer. (Noted March 27.)

CINCINNATI—Cincinnati Milling Machine Co. has plans for constructing a 400,000-square foot plant here.

CLEVELAND — Cleveland Graphite Bronze Co., Benjamin F. Hopkins, president, has tentative plans for inaugurating a plant expansion program amounting to $2,000,000.

LIMA, O.—Ohio Steel Foundry Co. is preparing to move its machine shop here from Springfield, O., and to build a new roll turning plant. Entire program will cost about $200,000.

MONTPELIER, O. — Village, J. M. Hoover, superintendent of utilities, is taking bids due at noon, April 26, on contract 2 in the construction of a water softening and filtration plant costing $75,000. Involves water softener, mixing and settling tanks, clear well, gravity filters and chemical feed equipment. Consulting engineer, H. P. Jones Co., Toledo, O. (Noted March 6.)

NEW STRAITSVILLE, O. — Village, John S. Wilson, clerk, will probably soon take bids for construction of a proposed waterworks costing $60,000. WPA funds allotted.

SPRINGFIELD, O.—City, W. H. Story, manager, is preparing plans and will soon advertise for bids on contract 2 in construction of a dam and waterworks costing total of $1,091,580. Contract involves filter plant and equipment amounting to $400,000. Alvord, Burdick & Howson, Chicago, consulting engineers.

TORONTO, O.—Ohio Edison Co., Mr. Funk, chief engineer, Akron, O., is completing plans and will accept bids at once in the construction of a 52-foot addition to its power plant at cost of about $3,500,000. Engineer in charge, J. H. Foote, chief engineer, Commonwealth & Southern Corp., Jackson, Mich. (Noted March 20.)

Massachusetts

FITCHBURG, MASS.—Harry Doehla Co. rejected first bids and will readvertise in a project to construct a two-story, 60 x 72-foot factory addition costing $40,000. J. S. Bilzerian, Worcester, Mass., architect. (Noted March 20.)

New Hampshire

NEW LONDON, N. H.—City sewer commission, H. Swift, chairman, proposes to construct a sewage disposal plant costing $46,100. F. A. Barbour, Boston, consulting engineer.

Rhode Island

GREENVILLE, R. I.—Greenville Finishing Co. Inc. is taking bi struction of a $40,000 addi boiler plant. Will install spr tem. C. R. Makepeace & Co., R. I., architects.

New York

AMSTERDAM, N. Y.—City plan to build a sewage disp at cost of $250,000 to end tion. Mayor A. Carter has ch

BINGHAMTON, N. Y. — A Corp. has purchased a six- adjoining its plant and will addition costing $40,000. Eng of owner.

NEW YORK—Pneumatic Too Repair Co. Inc., Queens, has b porated with capital of $14,00 and sell tools, air compressors Milton Eisen, 342 Madison ave York, is representative.

NORWICH, N. Y.—City, com cil, has plans, for maturity construct a sewage disposal cost of more than $50,000. S. city engineer.

SOUTH FALLSBURGH, N. water district will take bids May 1 in the construction of supply system costing about Alexander Potter, New York, engineer.

New Jersey

LINDEN, N. J. — Simmons awarded contract for building tory addition estimated to cos to Brown & Matthews Inc., Forty-second street, New York.

Michigan

STURGIS, MICH.—City, S. F. wax, clerk, takes bids until for two outside transformer bus structure for diesel pow and metal clad switchgear f power plant. Part of $275,0 project, Ayres, Lewis, Norris Ann Arbor, Mich., consulting e

Illinois

SHELBYVILLE, ILL.—Shelby co-operative, L. Boys, project tendent, is receiving bids on tion of about 217 miles of ru tric power transmitting lines $248,000. REA has allotted Young & Stanley Inc., Muscatin consultant.

STERLING, ILL.—Northweste & Wire Co., J. C. Foster, presid awarded contract for recon four units of its plant which cently destroyed by fire to P. Sterling. Cost estimated at $200,

WOOD RIVER, ILL. — Shell Inc., St. Louis, will soon let for constructing a one-story, 40 foot warehouse addition at its finery here.

Indiana

ELKHART, IND.—Elkhart Trail ply Co. Inc., 322 Harrison str been incorporated with capital of to manufacture metal parts for trailers. Organizers: W. A. Harris, Mates and Edith Harris.

Alabama

MOBILE, ALA.—Mobile & Ohi

New

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road, H. Austill, chief engineer, St. Louis, proposes to build a warehouse and docks costing total of $200,000.

PRATTVILLE, ALA.—Central Alabama Electric Membership Corp., Maury McWilliams, president, has received $380,000 REA allotment for constructing 455 miles of rural electric power distributing lines in three counties.

Maryland

BALTIMORE—Charles T. Brandt Inc. has awarded contract to George S. Awalt & Co., 718 Hunting place, for construction of a sheet metal shop costing $20,000. Structure to be one-story, 124 x 250 feet. Lucius R. White Jr., Baltimore, architect.

District of Columbia

WASHINGTON — Navy department, yards and docks, proposes to purchase a turbo-alternator, condenser, air ejector, and condensate pump for installation at the Newport, R. I., naval torpedo station. Specification 9108.

WASHINGTON — Navy department, bureau of supplies and accounts, receives bids until 10 a.m., April 11, on testing generators (schedule 5921); and until April 14 on electric windlasses (schedule 5918), motor-driven plate punch machine (schedule 5962), pelleting machine (schedule 5963), plate shear and turntable machine (schedule 5972), and motor-driven surface grinder (schedule 5973).

Kentucky

DANVILLE, KY.—City, board of councilmen, plans to build a sewage disposal plant and incinerator costing total of $100,000. H. W. Taylor, New York, consulting engineer.

Florida

CLEARWATER, FLA.—City, F. L. Hendrix, city manager, is receiving bids for constructing a sewage disposal plant, sewage pumping stations and force mains. Wiedeman & Singleton, Atlanta, Ga., consulting engineers.

Georgia

DECATUR, GA.—City plans to construct a water supply system costing $2,000,000. Roberts & Co., Atlanta, Ga., consulting engineers.

North Carolina

ELKIN, N. C.—Chatham Mfg. Co., T. Chatham, president, has plans for constructing a plant addition comprising 145,000 square feet and costing $500,000. Will mature May 1.

GREENVILLE, N. C.—Water and light commission, M. Swartz, superintendent, plans to build 101 miles of rural electric lines at cost of $80,000. H. L. Rivers, town engineer.

HALIFAX, N. C.—Roanoke Electrification Membership Corp. has received a $62,000 REA allotment for constructing 62 miles of rural power transmission lines. W. W. Corcoran, Halifax, consultant.

HIGH POINT, N. C.—City council has authorized issue of bonds not to exceed $4,000,000 to finance proposed municipal hydro-electric power project estimated to cost $6,492,000. (Noted Jan. 2.)

LA GRANGE, N. C.—City, C. G. Robson, mayor, votes April 18 on proposal for issuing $220,000 bonds to acquire and improve electric power and water systems.

South Carolina

ABBEVILLE, S. C.—City, J. A. Long, mayor, receives bids April 28 for constructing a dam and power house with complete equipment. Wiedeman & Singleton, Atlanta, Ga., engineers.

UNION, S. C.—WPA has approved $35,000 allotment to city for construction of a sewage disposal plant and extension of sewage collecting system.

West Virginia

WEIRTON HEIGHTS, W. VA.—City, Carl Frankovitch, solicitor, has completed survey in the proposed construction of a sewage disposal system costing approximately $50,000. Norman Parsons, Weirton Heights, Hancock county sanitary engineer.

Missouri

ELDORADO SPRINGS, MO.—City, C. H. Sunderworth, mayor, has completed plans and will set date soon for closing bids on construction of a diesel generating plant and distributing system. W. B. Rollins & Co., Kansas City, Mo., consulting engineers.

Wisconsin

DE PERE, WIS.—Duncan Equipment Co. has been organized here to manufacture metal and wood kitchen cabinets and sinks. A. E. Meyer, De Pere, is factory manager and treasurer.

LACROSSE, WIS.—Trane Co. has let general contract for erecting a one-story, 80 x 260-foot brick and steel factory addition to Austin Co., Chicago.

MILWAUKEE—Acme Galvanizing Inc., I. M. Herrmann, president, has purchased factory buildings and will equip 17,500 square feet for galvanizing, solder dipping, cadmium plating and chrome plating. Operations scheduled to begin May 1.

Minnesota

MABEL, MINN.—Village, W. I. Munson, clerk, takes bids until 7:30 p.m., April 18, on the construction of a sewage treatment plant. Certified check 10 per cent to accompany bid. Herman Hagestad, River Falls, Wis., consulting engineer.

Texas

AUSTIN, TEX.—Lower Colorado river authority, F. Englehard, chairman, is taking bids to April 28 for turbines, governors and generators for power plant at Marshall Ford project.

HOUSTON, TEX. — Southline Metal Products Inc. has been incorporated with capital of $19,000 to make mining and manufacturing equipment. Organizers: Harold Verson, Elizabeth Verson and Elliott Roberts, all of Houston.

SAN ANTONIO, TEX.—Guadalupe Valley Co-operative Inc., M. D. Linderman, president, has been allotted $157,000 by REA for erecting rural electric power lines totaling 198 miles in four counties.

Kansas

KANSAS CITY, KANS.—City is taking bids to April 12 on a motor-driven centrifugal pump for its new pumphouse costing total of $350,000. Burns & McDonnell Engineering Co., Kansas City, Mo., engineer.

North Dakota

WHITMAN, N. DAK.—REA has allotted $108,000 to the Five Electric co-operative, F. C. president, to finance const 100 miles rural electric lin four counties.

Nebraska

HARTINGTON, NEBR.—(Rural Public Power distric proval of state railway com construct 178 miles of ru power lines. H. H. Henning neering Co., Omaha, Nebr., engineer.

Iowa

POSTVILLE, IOWA—REA l $214,000 loan to the Allamak Electric co-operative, Joel Cl dent, to finance constructio miles of rural transmission serve consumers in three cou

SAC CITY, IOWA—Sac Cou Electric co-operative, D. W. M dent, to finance the construct miles of rural transmission l ing 344 consumers.

SIBLEY, IOWA—Village, R. I clerk, is receiving bids unti April 26, on installing boil controls, heaters, pumps, wa er, switchgear and other equ municipal plant. Certified ch cent to accompany bid. Youn ley, Muscatine, Iowa, consul neers.

WAVERLY, IOWA—Iowa Pu ice Co., A. E. Rathkey, gas su ent, Waterloo, Iowa, will co gas plant costing $20,000, ar ing air compressors, steel pro age tank and pro-pane ga equipment.

Wyoming

ROCK SPRINGS, WYO.—Uni Coal Co., Eugene McAuliffe, plans installing two addition and new 7500-kilowatt turbo in its power plant.

Idaho

ASTON, IDAHO — REA ha $80,000 loan to Fall River Rur fication Corp. to finance proje struction of 62 miles of rura power transmitting lines.

BELLEVUE, IDAHO—City pr install a new water system at timated cost of about $55,00 Merritt, Twin Falls, Idaho, c engineer.

MOSCOW, IDAHO—University regents have retained consult neer Lincoln Bouillon, Seattle, plans for a proposed boiler u central heating plant, for whic is available. Will receive bids 60 days.

Pacific Coast

LOS ANGELES—Western W Stamping Co., 2111 East 51st st permit for constructing an ad its plant.

SAN FRANCISCO — S.K.F. I Inc. has awarded contract t Bros., 206 Sansome street, for c ing a one-story warehouse $40,000. W. D. Peugh, San F architect.

NEWPORT, WASH.—City pro build a sewage system and dispo at total cost of approximately H. A. Sewell, Newport, engineer

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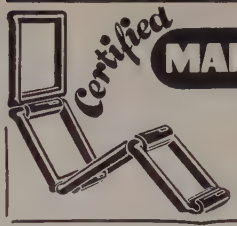

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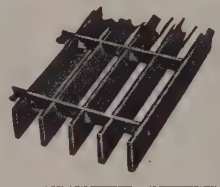

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that optimistically forecast, m
essary, early in 1938, the add
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feet of which is supported by
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1936.

American Bridge Company
fabricated and erected the st
steel for the complete doub
bridge, but also contracted for
ished lower-deck concrete r
and erected all railings, curb
other miscellaneous items a
roadway levels.

AMERICAN BRIDGE COMPAN

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UNITED STATES STEE

PACKAGED PERFORMANCE + OPERATOR & MAINTENANCE SAFETY + NEAT APPEARANCE

Knockouts on top

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d over line terminals

l Type A Safety Switch

upting Capacity

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cover

Operated

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7700 AC Contactor

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7322 Thermal Overload Relay

signed to meet Underwriters Laboratory

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thermal mechanism eliminates effect of

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time delay on tripping to prevent un-

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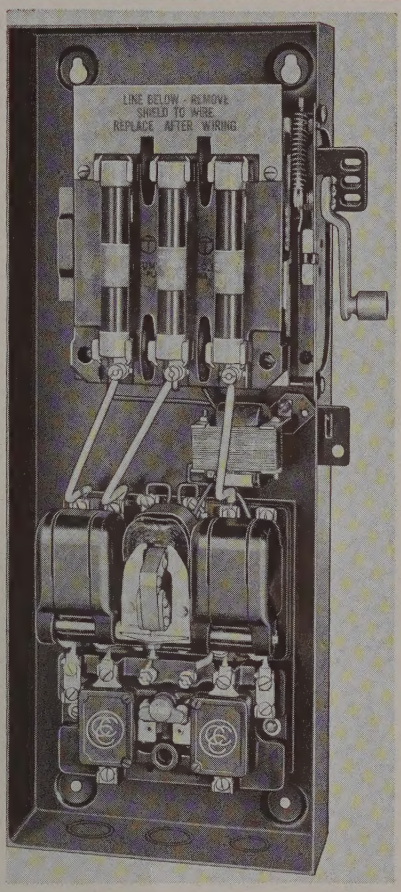

OPEN VIEW
SPECIAL
BULLETIN 6018
TYPE TM A.C.
ACROSS-THE-LINE
STARTER.

THE "3C" Bulletin 6018 Type TM Combination Across-the-Line Starter for Squirrel Cage Motors, combines an externally operated Disconnect Switch with the Starter, plus a Pilot Transformer, all contained in one neat cabinet. This combination provides maximum safety for maintenance men, and utmost in safety to operators. Its appearance is greatly superior to that presented by separately mounted and conduit-connected Safety Switch and Starter. Pilot device maintenance is kept at a minimum, and there is marked economy in installation.

Starter features Dead Front construction. Starter cover can be opened *only* when the handle is in the "OFF" position. Switch cannot be thrown to the "ON" position until the cover is closed. Fuses are mounted directly above the blades in a position readily accessible for renewing. Fuses are dead when the Switch is in the "OFF" position. With the door open, the fuses are dead, and are located some distance from the live parts, thus permitting inspection, repairing, or replacement of fuses with maximum safety. When the cabinet door is open, every part is electrically "dead." The "hot" line leads are covered by an insulating shield at the top. When the cabinet is open, it is impossible to contact "hot" lines without removing this shield.

Placing the Safety Switch and Starter with interlocked cover in a single housing makes it impossible to work on a starter without opening the Safety Switch, because the door will not open unless the Safety Switch is in the "OFF" position.

This device provides a transformer in the cabinet to step 440 volt input for use on main currents, down to 110 volts for use on the Pilot Devices.

Generous wiring areas, neat appearance, simple installation, low maintenance, maximum safety, and exceptional service under heavy duty are outstanding advantages of these Starters.

OFFICES IN PRINCIPAL CITIES

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One of two 200 Ton Morgan Stripper Cranes
Completely equipped with
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When buying Cranes, Specify EC&M